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The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

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[OFFICIAL NOTICE.]

May Meeting, Society of Gas Lighting.

OFFICE OF THE SECRETARY, May 3, 1898.

The May meeting of the Society of Gas Lighting will be held in "The Arena," No. 39 West 31st street, New York city, at 3 P.M., of the 12th inst.

FRED. S. BENSON, Secretary.

[OFFICIAL NOTICE.]

May Meeting, Guild of Gas Managers.

OFFICE OF THE SECRETARY, May 5, 1898.

The next regular meeting of the Guild of Gas Managers will be held in Young's Hotel, Boston, Mass., at noon of the 14th inst.

A. K. QUINN, Secretary.

[OFFICIAL NOTICE.]

Twenty-first Annual Meeting, Western Gas Association.

OFFICE OF THE SECRETARY,
NEW ALBANY, IND., April 6, 1898.

To the Members of the Western Gas Association: The twenty-first annual meeting of the Western Gas Association will be held at Detroit, Mich., May 18, 19 and 20, 1898, and will be called to order by the President, Mr. James T. Lynn, at 9:30 A.M., Wednesday, May 18.

The Russell House has been selected as headquarters, and the sessions will be held in a suitable room contained therein. The proprietors of the Russell House have agreed to fix these rates for the Association: Room, without bath, from $3 to $3.50; with bath, from $3.50 up.

The Executive Committee has arranged for the presentation of the following papers:

"The Enrichment of Coal Gas," by Mr. George H. Harper, Altoona, Pa.

"The Use of Gas for Purposes other than Lighting," by Mr. C. W. Blodget, Brooklyn, N. Y.

"The Igniting of Gas by Static Electricity," by Mr. Bankson Taylor, St. Paul, Minn.

"Recent Developments in Texas of Interest to the Gas Man," by Mr. Thos. D. Miller, Dallas, Tex.

"Methods of Estimating the Values of Gas Liquors," by Mr. O. O. Thwing, St. Louis, Mo.

"The Prepayment Meter," by Mr. C. H. Raynor, Adrian, Mich.

"Wrinkle Department," edited by Mr. E. H. Jenkins, Buffalo, N. Y.

"Some English Correspondence upon Isolated Generators for Bench Firing," to be read by Mr. G. Treadway Thompson, New York City.

The Michigan Passenger Association, the Trunk Line, the Central Passenger Association, the Southern Passenger Association and the Western Passenger Association, from points in Eastern Committee and Trans-Missouri Committee territories, have granted rates of 1½ fare for the round trip, conditional on the presentation to the Secretary of 100 certificates for indorsement. The territory covered by the above Asso-

ciations includes all States east of the Missouri and Mississippi rivers, except the New England States. It is further to be noted that the reduced rate applies to the following States and Territories west of the Mississippi and Missouri rivers: Kansas, Nebraska, Colorado, Utah, Wyoming, Oklahoma, Indian Territory and Missouri.

All persons attending the meeting should purchase a first-class ticket at starting point, paying full fare for same and obtaining from the agent a certificate stating that the person whose signature appears on same has purchased, at full tariff fare, one first-class ticket to Detroit, which certificate, after it has been signed by the Secretary of the Association and a representative of the above Passenger Associations, will entitle the purchaser thereof to a one-third rate, returning home.

All persons obtaining reduced rates must apply to agent at least 30 minutes before departure of train. All station agents do not have a supply of certificates, but the certificates may be obtained on request, provided the notification is made in time. Persons outside the territory covered by the Passenger Associations named above should purchase a ticket to nearest point within said Associations' districts, and from there purchase a ticket to Detroit, obtaining a certificate entitling them to a one-third fare returning to the place from which the certificate was obtained. The Western Passenger Association for the first time has granted reduced rates, on the certificate plan, from territory east of the Missouri river and west of Chicago, Peoria and St. Louis. It is to be hoped that this will induce members in the territory named to attend the meeting, and that it will influence other gas men not members to join our Association.

Do not travel to Detroit on mileage tickets; it is just as cheap to obtain a certificate. Nearly one-fourth of those who attended our meetings the last few years used mileage books, which practice interferes in extending the territory in which reduced rates are obtainable.

All queries sent to the Secretary for the Question Box will be assigned to members for answers.

A cordial invitation is extended to members of other Associations to meet with us and to participate in the discussion of papers presented.

The Secretary will be pleased to answer any communication pertaining to the meeting, and will mail applications to those who desire to become members of the Association.

JAMES W. DUNBAR, Secretary.

[OFFICIAL NOTICE.]

Wrinkle Department, Pacific Coast Gas Association.

MERCED, CAL., March 11, 1898.

To the Members of the Pacific Coast Gas Association: At the last meeting of the Pacific Coast Gas Association to me was delegated the duty of collecting and presenting any matter, in the shape of original ideas or special devices, which may come under the head of "Wrinkles," to be presented in proper form for the benefit of the Association at the next regular assembly.

Many of our members having charge of gas plants on the Coast have many plans, that are practical, handy and labor-saving, which many others by force of circumstances have never seen, but who, on presentation of the device, drawn and described, or through the medium of our official organ (the AMERICAN GAS LIGHT JOURNAL), would gladly embrace the opportunity, and put into practice a plan very beneficial—which perhaps had been in use in some obscure place many years, used exclusively by one man—that would, when given daylight, benefit the whole gas fraternity.

On reading this communication, please see if you have not forgotten something in the shape of a "Wrinkle," that is doing good service in your works, that would be of great importance to the Association. Your answer to this will greatly oblige.

GEORGE H. HOLLIDGE,
Editor "Wrinkle" Department.

BRIEFLY TOLD.

THE MEETING OF THE WESTERN ASSOCIATION, NEXT WEEK IN DETROIT.—Every indication points to the pleasing knowledge that the Western Association is to register the occurrence of its birthday next week in Detroit, which anniversary, as we noted a fortnight ago, marks "the attainment of its majority," with an attendance that will outdo all of its preceding roll calls. And that is saying much, since the Western has had many phenomenal musters. The Eastern delegation will send a company recruited to full quota, on which matter our statement may be taken for granted in advance, in that some of the details for the transportation of the company have been committed to our care. The preliminary matters regarding the meeting itself, in respect of technical programme, headquarters, meeting room and entertainment list, have been thoroughly arranged to the complete satisfaction of President Lynn, Secretary Dunbar, and Col. Jerome Croul, Chairman of the Entertainment Committee; and if they are satisfied, no room for fair objection lodges, for the gentlemen named know what to do, as well as when and how to do it. We hope that the delegates concerned will pay due heed to Secretary Dunbar's official notice that "The Western Passenger Association, for the first time, has granted reduced rates, on the certificate plan, from territory *east* of the Missouri river, and *west* of Chicago, Peoria and St. Louis." If that sentence is thoroughly examined, the concession that it implies, if practically applied by the residents in the district specified, should result in applications for membership from many who hitherto have considered that the expense involved in attendance on the meetings prevented them from making the trip. Another point in connection with the transportation details that is worth again bringing out is the Secretary's admonition, "Do not travel to Detroit on mileage tickets; it is just as cheap to obtain a certificate." Members and visitors should remember that he does not harm himself who in helping others aids all. Col. Jerome Croul, Chairman of the Entertainment Committee, has put together a royal sequence of events for the outing; and prominent therein is a "boat ride to the St. Clair Flats," to be brought off on Friday. In our last editorial mention (April 25, p. 650) of the meeting we referred to the theme of the proposed paper, by Mr. Bankson Taylor, of St. Paul, Minn., the subject of which is "The Igniting of Gas by Static Electricity." We thought Mr. Taylor proposed to have something to say about the automatic lighting of gas by means of electricity, but in that assumption we were mistaken. However, Mr. Taylor's narrative will have sufficient interest for his hearers, in that he proposes to relate an account of an explosion of gas caused by static electricity generated by a belt that was running a machine, located near a station meter, when the latter was being repaired, and from which the gas had been turned off. There can be no doubt that the meeting will be an entirely successful one.

A CORRECTION.—Mr. J. H. Fitzgerald, Superintendent of the Houston (Texas) Gas Light Company, writing under date of April 28th, says:

To the Editors AMERICAN GAS LIGHT JOURNAL: In your report of the Laredo meeting of the Texas Gas and Electric Light Association (see JOURNAL, April 25, p. 651), my answer to question No. 1 is slightly in error, and you will oblige me by publishing the following: My method of testing pipe for services is to use two 6 branch tees, connected together with a nipple, making it the equivalent of a 12-branch tee, which would answer the same purpose. The tee is placed on a wide trestle, and another trestle of the same height is set back some distance, to support the other end of the pipe. Screw the pipes into the branch openings on the tee, plug the coupling on the other end and turn on the steam.

A WELL-MERITED PROMOTION.—Last week we had occasion to briefly report that, at a meeting of the Directors chosen to manage the affairs of the Columbus (O.) Gas Company for the ensuing year, one result of the meeting was the promotion of Mr. Irvin Butterworth to the honorable and responsible place of President of the Company. Mr. Butterworth has long been in fact the guiding genius of the Columbus Company, so far as bearing the brunt of its actual direction was concerned; and it is with right good will that we congratulate him on his accession to the formal official recognition that his present appointment carries. Our worst wish for him in his advancement is that the only force that can disturb him therein will be the piling upon him of many years.

NOTES.—In our current issue (p. 737) will be found an article, by Mr. Herman L. Hartenstein, whose topic is "New Economies in Iron Making." From its caption the article would never enlist the first attentive thought of an ordinary gas manufacturer, but an encounter with some of its paragraphs would be quite likely to provoke mental combat between the gas man and Mr. Hartenstein's theories. Of making gas processes there is no end, but we submit that his scheme has the merit of being the latest and newest and oddest. In fact, it is so new that Mr. Hartenstein has evolved a name for it—"Carbolite." From present knowledge, however, and despite its sponsor's enthusiasm, we fear that "Carbolite's" chances for success in ordinary commercial gas supply are not half so promising as are the chances in like field of acetylene gas against commercial gas—and acetylene gas has no chance whatever therein.——The Pacific Gas Improvement Company, of San Francisco, has entered into a contract with the Western Gas Construction Company, of Fort Wayne, Ind., for the installation of a set of the Con-

struction Company's improved Lowe water gas apparatus, of double superheater type, the capacity of the installation being put at 1,250,000 cubic feet per day. The plant will be erected complete, which means the furnishing of all auxiliary fittings.——The Board of Gas and Electric Light Commissioners has authorized the Malden and Melrose (Mass.) Gas Light Company to issue $115,000 of new capital.——At the annual meeting of the Cincinnati (O.) Gas Light and Coke Company the Directors chosen were: A. Hickenlooper, Robert Allison, J. H. Bates, W. A. Goodman, A. Howard Hinkle, George N. Stone and J. T. Carew.

Some Notes on Street Lighting.

[Prepared by President J. T. JOLLIFFE (Ipswich, England) for the last meeting of the Eastern Counties Gas Managers' Association.]

Satisfactory street lighting should at least allow you, when walking in the streets, to readily recognize the features of any passer by. Anything less is not satisfactory, and in very populous and busy centers more is required. Mr. Sugg, in a paper which he read before the Gas Institute in 1879, laid down a reasonable and fairly practicable standard for street lighting. Some of you may probably remember the clever cartoon which accompanied the paper, in which a gentleman was portrayed, fully clothed, and with the regulation top hat, walking along the highway, carrying at the end of a stick a lighted lantern. Mr. Sugg, in this paper, says: "This standard is a man lighting his way with a lantern. The light is fixed to a stick in the manner most approved by our ancestors; it is, in fact, so used in the country at the present time. The height of the lantern from the ground is just 2 feet to the center of the flame. If the lantern is provided with a parliamentary spermaceti candle it will, in the position I have stated, light a circle 4 feet in diameter. The amount of light anywhere on the edge of this circle will be sufficient to enable a man with good eyes to read a leading article in the *Times* newspaper lying on the ground. This light will just enable a man to see his way before him as he walks. In a well-lighted neighborhood, where the local authorities allow each lamp 5 cubic feet of gas per hour, and there are no shops, it will be found that this is the average kind of light which is found at 7 feet 6 inches from the lamp post, the lamp being 10 feet from the ground." He also, in the same paper, gave a diagram showing that, with a 10-candle burner fixed on a post 8 feet high, this light is given on the ground at nearly 10 feet from the post; with a 20-candle burner this light is found 15 feet 9 inches from the post; with a 50-candle burner 26 feet from the post; with an 80-candle burner 33 feet 6 inches from the post; with an 115-candle burner 39 feet 6 inches from the post; and with a 200-candle burner 54 feet from the post.

Here, then, is a standard worked out to lights of varying intensity and from which we can at once calculate how near to this standard of excellence is the lighting of the streets of the towns with which we are more particularly identified, and see whether it is possible for us, without materially increasing the cost to the ratepayers, to approach this standard. To illustrate what may be done I will state my own experience at Ipswich.

In Ipswich the maximum distance apart of the lamps is 80 yards. In the center of the town the distance is not so great, and I am glad to say that, on the advice of Mr. Sayer, this distance is gradually becoming lessened. Prior to 1870 the consumption of gas in each street lamp was at the rate of 5 cubic feet per hour. In that year—probably from motives of economy, evidently very mistaken motives—the rate of consumption was reduced to 3½ cubic feet per hour; and you will readily understand what a miserable exhibition the street lighting became. Instead of being able to recognize people at any spot between the lamps it was impossible to recognize your most intimate acquaintance at the base of the lamp post, and, as a safeguard, the lights were absolutely useless. This system remained in force until 1887, when the consumption of gas in a number of the lamps in the center of the town was increased to 5 cubic feet per hour, and gradually the number was extended.

After some long and exhaustive trials with incandescent burners in the public lamps, I suggested to my directors that we might, with advantage, undertake to light the whole of the streets in the borough with these burners, and, knowing how desirous our lighting inspector was to improve the street lighting of the borough, I intimated to him that we were not indisposed to co-operate with him in any scheme he might formulate for the consideration of his committee. The outcome of this was the subjoined report which Mr. Sayer laid before his committee and which was accepted.

Mr. Sayer's Report.—Relative Illuminating Power of Various Burners Compared with the Welsbach Burner and Oil.

Burner.	Pressure.	Gas Consumption. Cu. Ft. per Hour.	Candle Power per Methven Standard.
Bray's batswing, No. 4.....	10 tenths	5.0	4.8
" " No. 5.....	"	6.0	9.6
Ordinary street governor....	"	5.0	14.0
" argand burner.....	"	5.0	15.8
Welsbach burner with glass chimney.....	"	3.75	68.4
Welsbach burner, with mica chimney.....	"	3.5	60.0
Welsbach burner, after three months in use.....	"	3.75	40.0
Belge oil lamp.....	consumption 2 oz. p. hr.		16.0

The light of the Welsbach burner is intensely white and brilliant, being equal, for only 3½ cubic feet of gas consumed, to a maximum of from 50 to 60 candles, and a certain average of 40 candles. The photometric measurement of a mantle that had been three months in constant use is interesting, as showing how satisfactorily the illuminating power is maintained, while its illuminating power expressed in candles is more than three times as great as the best ordinary gas burners or the incandescent electric lamp, each of which does not generally exceed 16-candle power, unless a very great expense is no object to the consumer. I am far from saying that the incandescent system of gas lighting has now been brought to the highest pitch of perfection, still I am bound to regard it as the system of gas lighting which utilizes most efficiently and most economically the full powers of coal gas as an illuminating agent. Some have expressed fears that the burner is a delicate instrument, but I have found, with ordinary care, that these fears need not exist. The average life of a mantle, taking risk of breakage into consideration, is between three and six months, but I have used mantles for over a year, and at the end of this time their lighting efficiency was still very good.

The cost of each street lamp burning 5 cubic feet of gas per hour is now as follows:

Number of hours that each public lamp is burning = 3,670.

3,670 × 5 = 18,350, at 2s. 10d. per 1,000 cubic feet..... =	£2	12	0
Less discount at 5 per cent.....	0	2	7½
Cost of gas.....	£2	9	4½
Lighting, extinguishing and cleaning.....	0	17	0
Total cost of lamp per annum.....	£3	6	4½

If the incandescent system were adopted, the consumption of gas would be somewhat less, and the cost as follows:

3,670 hours × 3.75 cubic feet per hour = 13,765 cubic feet for burner.			
5,096 " × 0.25 " " = 1,247 " by-pass.			
Total gas..... 15,036			
15,036 feet at 2s. 10d. per 1,000.....	£2	2	7
Less 5 per cent. discount.....	0	2	1½
Cost of gas.....	£2	0	5½
Lighting, extinguishing and cleaning.....	1	0	0
Total cost of gas, lighting, cleaning, etc., but exclusive of renewals of mantles and chimneys.....	£3	0	5½
Present total cost per lamp per annum.....	£3	6	4½
Cost of incandescent burner, exclusive of renewals of mantles and chimneys.....	3	0	5½
Balance.....	£0	5	11½

Now, assuming that each burner needs six mantles, six mantle rods and two glass bowls per annum, we have £3 0s. 5½d. + 7s. 6d. + 3s. 3d. = £3 11s. 2½d. per annum as the total cost of each incandescent lamp, being 4s. 9½d. per annum more than the present cost. There are 820 lamps, burning 5 feet per hour ∴ 820 × 4s. 9½d. = £197 6s. 3d.

The introduction of incandescent burners will, however, enable the authority to reduce the consumption of gas in 57 large lamps, as follows:

34 lamps, now burning 7 feet, reduced to 5 feet per hour, 34 × 2 × 3,670 = 249,560 cubic feet.
23 lamps, now burning 10 feet, reduced to 5 feet per hour, 23 × 5 × 3,670 = 422,050 "

672,610 at 2s. 10d. = £95 5 8
Less 5 per ct. dis. = 4 15 8
£90 10 0

Deducting this saving of £90 10s. from the above cost of £197 6s. 3d., and adding £13 14s. 4d. for the above 57 lamps, gives £120 10s. 7d. as

the probable net additional cost of adapting incandescent burners to 877 of the public lamps. I have every reason to believe the Company would fall in with the above arrangement, and our borough would lose the stigma of being the worst lighted town in the Eastern counties.

What Came of It.—A contract for three years was entered into between the corporation and the Gas Company on the terms set forth in this report. The burners were duly installed, the result being very striking, and the satisfaction of the ratepayers immense. Whereas before the assumed standard for public lighting extended only to the edge of a circle having a diameter of 20 feet, with the lamp post at its center, under the improved conditions the standard was 60 feet. The corporation obtained five times the amount of light for an increase of about 1½ per cent. in the expenditure.

For this installation it was decided to use the Incandescent Gas Company's "C" burner, fitted with bulb and metal reflector, by-pass lever cock, and chains, and anti-vibration springs specially made by them for street lighting. This form of burner was chosen because of its greater strength and its better capability to withstand the rough usage of street lighting. No alteration was made to the lanterns, beyond reducing the size of the apertures at the top and completely closing the openings at the bottom, excepting the small holes in the glass for the chains to work through. Before fixing the burners the upright pipes were shortened, to allow of a T-piece with plug being inserted just below the burner, the object of the T-piece being to provide means for clearing the serv ice. Above the T an ordinary lamp cock was fixed, and next to this the burner itself, fitted with a Peebles' governor, regulated to pass 3.75 cubic feet of gas per hour. The total cost of the installation was something under 15s. per lamp. Our estimate as to the cost of maintenance was six mantles, two glass bulbs and six props per lamp per annum, and it is satisfactory to know that after three years' experience this estimate has not been exceeded.

Care was taken, when fixing the burners, to keep both the supply pipe and the burner itself clear of the lantern, so as to prevent, as far as possible, damage to the mantles from shock or vibration. The lamp lighters report each morning any damaged mantles or defective lights, and men are told off at once to attend to the same. These men become very skilful in the manipulation of the mantles, and it is rarely that they meet with a mishap.

It is found in practice that the difference in the gross and the net price of the mantle is sufficient to pay the cost of attention. Although the lanterns themselves require less cleaning than under the old system of lighting, it is very desirable to have both lantern and globe cleaned at least once a week, as dirt seems to interfere more with the light emitted from a Welsbach burner than from an ordinary flat flame burner. All the burners are thoroughly cleaned and the service pipe blown out, in the autumn of each year.

In concluding these brief and neccssarily fragmentary remarks, it will be seen that the incandescent burner offers an easy and economical means of enormously improving our street lighting, even in its present form; and if the new burner which the Incandescent Gas Light Company purpose putting on the market in June next should give anything like the efficiency promised, we shall have at our command the means of giving to the public, at little or no extra cost, a light which will at once fulfill the standard conditions fixed by our friend Mr. Sugg. And, personally, I have no doubt that the promised burner will give, at all events, some of the results promised, for my assistant, Mr. Prentice, has had constructed at our works a Bunsen burner so perfect that, when consuming 5 cubic feet per hour it gives a light, with an ordinary mantle, equal to 130 candles, or 26 candles per cubic foot of gas burned. If we, with comparatively little or no experience in the construction of burners, can make a burner yielding such high efficiency, what may we not expect from the Incandescent Gas Light Company, with their skill and experience? Their new burner is to yield a light equal to 30 candles for each foot of gas burned, so that a burner consuming 5 cubic feet of gas will give a light equal to 150 candles. Lights of this power placed 50 yards apart would brilliantly illuminate any street of ordinary width, and could be carried out where gas is the same price as in Ipswich at a cost of about 9d. per mile per hour.

Discussion.

Mr. W. J. Best, St. Ives, said that latterly local authorities and corporations had been somewhat infatuated with incandescent gas lighting. They had done a little with it in his town, but he could not say they had made much progress. His opinion was that the ordinary lamp post was too flimsy for the incandescent burner. The streets of his town were cobbled, and the result was that the mantles got such nasty shocks that they could not get over them. The posts were too flimsy and the lanterns too open, with the result that shock and wind wore out the mantle; that, in his experience, had been the cause of failure. The corporation and inhabitants would like improved lighting, but they did not feel disposed to buy new posts and new lamps to meet the requirements of the incandescent burner, and neither did the gas company. He had seen in Leicester, outside the Corporation gas offices, good substantial pillars and windproof lanterns, and, Leicester having the advantage of an electric supply, a touch of a button sufficed to light these lamps when the gas was turned on. He thought that was one of the finest and most up-to-date things he had ever seen. Where they had not good substantial pillars and lanterns very nearly air tight, incandescent burners could not be used.

Mr. W. D. Child, Romford, thought they were all agreed that in these days local authorities were more alive to the question of lighting towns than they formerly were, but his own experience led him to the conclusion that they were scarcely going on the right lines. Lighting was made subservient to the question of rates, with the result that the ordinary street lamps were spread out at distances of 100 or 120 yards apart, the only use of which was to show that there was a light and to prevent one running up against that particular lamp post. Beyond that they had no earthly value for either reading or walking. Public lighting had been improved by the adoption of the incandescent burner; but he must say that in his own experience he could not nearly approach the figure of 6 mantles as the annual renewals. His average was between 12 and 14 mantles per annum. On 160 lamps, from Christmas last up to the present time, he had used 546 mantles, and even at that they were not renewed so frequently as they ought to be—he did not renew them immediately they showed a ragged fringe. Perhaps this heavy mantle account might be due, in part, to the circumstances of the town—a clay soil with granite macadam in the streets. There was a great deal of vibration, so much so that sometimes when a mantle was being put on it would jump out of the crutch. Of course, such vibration had to be overcome either by suspending the burner or by supporting it upon a simple form of wire stand, with a connection of high class rubber tubing. He thought any one proposing to adopt incandescent lighting would have to face the question of also adopting lamps adapted to the system.

Mr. Best—New posts also.

Mr. Child had nothing to say against the posts in his town; they were very substantial. They had also the cradle arrangement of lantern, which was another cause of vibration. He thought a lantern coming down upon a "frog" would be an advantage. Taking into account the first cost, not only of the burner, but also of a proper lantern, he thought it would ultimately pay any gas company to put in such an installation rather than go on with the old improperly ventilated lanterns, as these latter were the cause of many breakages.

Mr. R. G. Shadbolt, Grantham, said that the President had called his paper a fragmentary one, but he did not look upon it in that light. Even assuming that it was a fragment it was a very good one, for it snatched from the oblivion of the past something valuable that otherwise might have been overlooked. While listening to the paper he could not help thinking how much better it would be had gas managers the lighting of their respective towns in their own hands from the service pipe to the burner. He knew of several places—one in particular—where the lamp columns, lamps and everything else were provided by the local authority, and the gas was purchased at the lowest rate, where the consumption, through Sugg's regulator burners, was 3 cubic feet per hour, and the lamps placed not less than 100 yards apart. How town councillors could expect streets to be properly lighted in that way gas managers could not conceive. The great difficulty was that the lighting was not in the gas manager's hands. In his own case the lighting was in the Gas Company's hand, and he ventured to say that the town benefited distinctly from the arrangement. One thing in the President's remarks struck him as rather peculiar. It was said that a T was put in for the purpose of facilitating the cleaning out of the service pipe. He should like to know why the service pipe required cleaning out, as he has not experienced any such necessity; he knew that the incandescent burner required a great amount of cleaning. Then there were some figures in Mr. Sayer's report which he did not understand. The candle power of a No. 4 Bray, with a consumption of 5 cubic feet per hour, was given as 4.8, and that of a Welsbach, with 3.75 cubic feet, as 68.4. Were these totals, or what were they?

The President said the last named must be a total.

Mr. Shadbolt pointed out if the figure for the Bray was also a total it meant that the efficiency was less than 1 candle per cubic foot. If that was the case it must have been a very bad burner, and the same remark applied to the second Bray burner referred to. He had been

recently testing ordinary burners—they were Hawkins and Barton's—and with 17½-candle gas they gave 14 candles for a consumption of 5 cubic feet per hour. If Mr. Sayer's costs were worked out on that basis he could not agree with them. His own experience bore out the claim for 6 mantles for 3,000 hours' burning, with rods and globes in the proportion mentioned in the latter part of the paper. With regard to what they were doing at Grantham, there the gas company owned the lamps and all appertaining to them, and they did the lighting by contract, under a sliding scale, governed by the price of coal. If the price of coal went up 1s. per ton in any year, then the contract price for lighting was raised 1s. per lamp for 2,000 hours' lighting; the consumption per burner was 5 cubic feet per hour. He went into the matter sufficiently to enable him to say to the Corporation that if they would increase the cost of lighting by 16 per cent. the gas company would be prepared to guarantee an increase of 300 per cent. in the lighting. Turning to another point, they had often heard it said that it would be a great advantage if a stronger mantle were put upon the market. He very much doubted that. He had said that 6 mantles per annum was fairly correct, although he had come as low as five, and even down to two. But he had had to renew mantles, not because of breakage, but simply because the light had become dim. Whether that was due to failure of catalytic action or not he did not know, but there was the fact. He had had two mantles burning for over two years, and they were still giving a good light; but, speaking generally, the mantles growing dim compelled them to renew at the rate of 6 mantles per 3,000 hours lighting. The results obtained by Mr. Prentice were certainly remarkable, and he hoped he would have an opportunity of inspecting his burners. He had come to the conclusion that the best results were obtained the more nearly they approached an explosive mixture of gas and air. He arrived at that conclusion from experiments he had made himself, more particularly with the Sunlight mantle. But the recent announcement of the Welsbach Company of 30 candles per cubic foot, irrespective of consumption, far and away exceeded what he had been led to expect, and he could not see how it was done. Mr. Best had evidently fallen upon evil times and evil circumstances. He (Mr. Shadbolt) had not been called upon to deal with flimsy lamp columns; but he could not conceive that the lamp column had so much to do with it as the service pipe had. So far, his experience was that the service pipe and not the pillar was responsible for the smashing of mantles. A service pipe might be in contact with a stone, and vibration would thus be communicated to it. In one troublesome case he put on a Denayrouze burner, which had neither chimney nor bulb, and the vibration was so great that the by-pass screw was shaken out. But the remarkable thing was that the mantle withstood that vibration very well. With the ordinary incandescent burner the chimney was always toppling over and destroying the mantle. With regard to anti-vibrators, it had been very well said that they were more mantle destroyers than mantle preservers. After trying all kinds, sizes and sorts, he had discarded them all.

Mr. Best said the streets of his town were cobbled and traction engines were frequent visitors. When these went by he might say good-bye to the mantle. With macadamized streets they would not have the same vibration.

Mr. Prentice, Ipswich, said he had made a vast number of experiments in trying to find out what constituted a good burner, and therefore the discussion was particularly interesting to him. Mr. Best appeared to have great difficulty, and he attributed it very largely to the posts. He (Mr. Prentice) was of opinion that the posts had nothing to do with it. It was the service pipe that they wanted to protect. In Ipswich they had a variety of ways of treating lamps, as the cause of damage might not be the same in any two lamps. They now used less than 6 mantles per lamp per annum, but he was certain that the number would be reduced by one-half when every lamp had been specially attended to; when the cause of damage had been found out and removed. They used "frogs" for the support of the lanterns; and he did not think any one could expect mantles to last long if the lamps were moved about by the wind. As to traction engines, they had a great many of them moving about in Ipswich, and he did not think they could be the cause of much damage to mantles if the service pipes were low enough, and were not in contact with stones. There was no doubt that the lighting power of mantles was reduced after a time, but he did not think the reduction was so large as Mr. Shadbolt had suggested. He had noticed one or two things that caused mantles to become dim, and one of them was the use of partially purified gas. A slight taint of sulphureted hydrogen in the gas would reduce the light.

Mr. Best—Sulphureted hydrogen is not tolerated now.

Mr. Prentice, continuing, said another cause, especially in the summer time, was the accumulation in the burner itself of thousands of tiny flies. If they "blew the burner out," when the mantle showed signs of becoming dim, he thought they would get something like 40 candles out of that mantle. Mr. Shadbolt could not understand how a burner could give 30 candles per foot of gas for any consumption between ½ foot and 10 feet. That statement, he believed, was made under a misapprehension. The real fact was that the Welsbach Company made a variety of burners, each of which would give 30 candles per cubic foot for the quantity of gas that particular burner was made to consume. He had not seen the new burner, but had seen a rough sketch of it—but he had no doubt that the result claimed could be obtained. He had himself got something very near it. It was not a difficult thing to do; they had only to produce a flame of such a size as would fit the mantle, so that the mantle would be in the hottest part of the flame. With the burner he had had made he could get 26 candles per foot with ease, and he had obtained as much as 26.9 candles. Perhaps he would even be able to get as high as what was claimed for the new Welsbach burner. That the Somzee-Greyson burner, which worked with a pressure of 7½ inches, gave an efficiency of 30 candles per cubic foot he had not the slightest doubt.

Mr. Shadbolt, referring to Mr. Prentice's remark about "blowing out" the burners, said he found that it was not only necessary to renew the mantles six times in the year, but that the burners had to be taken to pieces and cleaned out every time. When the mantle became dim no amount of cleaning restored it to its former state.

Mr. A. Drage, East Dereham, said he averaged less than six mantles per annum for renewals—his figures were about two mantles per 1,800 hours' burning. There were traction engines running about the town all day long, but he had never had any mantle broken by the vibration. He made a point of keeping the service pipes as low as possible, and in this way he avoided vibration. He found that with light lanterns the mantles were broken by the wind, but with heavy copper lanterns, such as he now used, he had no trouble. He did not renew the mantles when they showed ragged edges, but he did when they began to grow dim. A great deal depended upon the proper mixing of the gas and air, and he found that the light could frequently be restored by reaming out the air holes. He had now done away with the chain-operated tap, and worked from the service cock, from which he also took the by-pass.

Mr. J. H. Sheldrake, London, said the two great points in incandescent lighting were the insulation of the service pipe from the lamp column and a properly constructed lantern. With lanterns too open at top or bottom mantles had not a chance. He had come across samples of incandescent lighting in London where there was a great waste of mantles, and when they were investigated it was found that the service pipe was wedged into the lamp column in such a way that all vibration was conveyed direct to the mantle. By removing these wedges the mantles were saved. Mention had been made of the new burner of the Welsbach Company, which had been reported as giving 30 candles per cubic foot of gas for any consumption. The previous evening he had himself tested one that gave 114 candles with a consumption of 4.2 cubic feet of gas per hour—that was a burner that had no chimney; and he hoped that in a very short time—at the beginning of May—the Welsbach Company would give an exhibition of the burner in London; and he believed it would be a very great success, especially in street lighting. What was wanted was a burner that would give 100 candles for a consumption of 4 cubic feet per hour, and it was bound to come.

Mr. R. J. Sharman, Wisbech, said that last year they made a fresh contract with the town, one condition being that so many incandescent lights were to be given. He had had considerable trouble with the burner, but he was not to allow it to beat him, because the public were so pleased with it that they did not mind paying a little more for it. He had not got down to six mantles, or anything like it, but he hoped to do so in time. He did not trouble much about the service pipe or the post, but believed in paying attention to the construction of the lamp. He had derived great benefit from suspension burners connected by india-rubber tubing.

Mr. Child said he had some lamps in the Market Place, which was paved with granite cubes, and the mantles did not average more than three or four days. He then supported the lamps on four thin wires, with rubber connection, and the mantles lasted as many months as they had done days before the alteration. He did not think the number of hours burning had much to do with the life of the mantle; mantles were as likely to be injured during the day as when they were giving light.

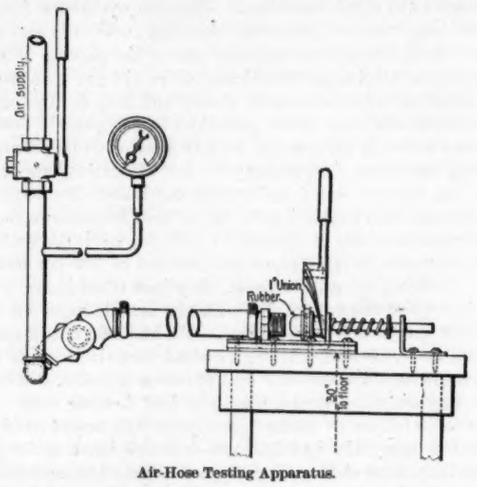
The President said that after the discussion they had had he was more sorry than ever that Mr. Sayer was not present. In Mr. Sayer he had

a gentleman with whom he could co-operate, and he thought it should be the policy of gas companies to co-operate in every possible way with the lighting authorities, and even to go out of their way to do so. It was only by hearty co-operation with lighting authorities that they could hope to have gas hold its own against its more modern competitor. Mr. Best appeared to have been very unfortunate, but he should strongly advise him not to give up; if he only tried he was sure he would succeed. It should be remembered that each burner and lamp post required separate treatment to make it effective. Nearly the whole of the discussion had been concerned with the life of the mantle. Well, he could tell them that in his experience his first estimate in that respect had not been exceeded. Of course, although the general result had been satisfactory, they had had burners and lamps that had used up 19 or 20 mantles per annum. But they did not allow them to go on like that; they found out the cause and removed it. He agreed with Mr. Shadbolt that the lamps and columns should belong to the gas companies, as then they would have greater control over them. Personally, however, he had no trouble in this respect, and Mr. Sayer cooperated with him to make the lighting as successful as possible. He could not explain the figures in Mr. Sayer's report mentioned by Mr. Shadbolt. Evidently the Bray burners must have been very inefficient ones, because they all knew that these burners gave 2.3, 2.4, or even 2.5 candles per cubic foot of gas burned. Generally speaking, however, he agreed with Mr. Sayer's tests. He also agreed with Mr. Shadbolt that it was not wise to run a mantle for too long a time, as there was a very serious diminution of light after a long period of use. He did not think he would try to do much more than renew at the rate of 4 mantles per annum. The cleaning of the burners was a most important matter. They cleaned them thoroughly every autumn, before starting the winter season, and when that was done the mantle gave almost its former light. He thought Mr. Drage was entirely wrong in interfering with the burner as made by the Welsbach Company. The skill at the disposal of the Welsbach Company produced a very cleverly constructed burner, and it was not for them to interfere with it. He fancied that any changes Mr. Drage had noticed were more due to local causes than to the air passages. He had been very much struck with the actual results obtained by the Somzee-Greyson burner. He had made some experiments with it, and he found it had an efficiency of over 30 candles per cubic foot with the Welsbach mantle. The result with the Sunlight mantle was not so high. But a fatal drawback to the burner was that it required a motor to produce a pressure of 7½ inches, which was sufficient to draw in enough air to bring the mixture to very near the explosive point, to which, as Mr. Shadbolt had said, he had no doubt the efficiency was due. On account of the need for a motor the burner was only applicable in cases where power was at hand, such as for the lighting of workshops. The Somzee-Greyson people claimed that they had strengthened the mantle by means of some solution, and this was undoubtedly true, because they could handle it in a way that the ordinary mantle would not stand. The new mantle issued by the Welsbach Company, which was called the "C X," was much stronger than the earlier ones, and it was also more efficient.

Apparatus for Testing Mounted Air Hose.

Mr. Oscar Autz, writing in the *Railroad Journal* about ways and means for testing mounted air hose, says that, while it is not a universal practice to subject air hose to a test pressure after being fitted up, it is nevertheless desirable that this should be done, and the present practice of splicing hose which has become partly defective it is necessary to apply a test to insure having perfect work. The engraving illustrates an apparatus which has been found to answer very well for this purpose, and with it one man can test a hose thoroughly in less than half a minute.

The air pipe supplying the test pressure is provided with an ordinary cutout cock having a ¼-inch hole drilled in the side of the chamber and plug, forming a three-way cock, by means of which air-pressure can be applied to the hose and released at will. A gauge is connected to the supply pipe. Below the three-way cock is located a one-inch hose coupling having a one-inch pipe thread cut on the shank, which is screwed into an elbow and in connection with another elbow can be placed at a proper angle so that a hose coupled to it will lie in a horizontal position. The nipple of the hose to be tested is closed and made tight by means of a piece of rubber turned in a lathe to the shape shown. This is held by the nut of a union screwed on the male part of the union. To hold the hose so that this rubber can be forced against its ends, a fork-shaped piece of metal is provided which fits into the space between the back of the hexagonal part of the nipples and the hose clamp, which space is usually from one-fourth to one-half inch. This fork is made of a piece of ⅜-inch sheet steel and is



Air-Hose Testing Apparatus.

bent in such a shape that the base projects at the two sides, so as to slide in guides fastened to a table, to adjust its position to varying lengths of hose. On the end opposite the fork is a flange against which a wedge bears for forcing out the rubber against the hose nipple. A continuation of this flange forms a fulcrum for the operating lever of the wedge. This wedge is made circular and has a slot through the center which keeps the union holding the rubber plug from turning. The pipe end of this union is plugged with a piece of iron into which is screwed a piece of ¼-in. round iron to act as a guide; the back end of this part of the union is tapered at the sides to the same pitch as that of the wedge; the center being allowed to project so as to work in the slot of the wedge. A spring on the guide rod bearing against a washer and pin brings the union back against the wedge when this is raised.

The operation of testing a hose consists in placing the coupling end into the stationary coupling, then dropping the nipple end over the fork and pressing down the lever of the wedge, which forces the rubber against the nipple, making a joint which is tight against a pressure of 100 pounds per square inch or less. Pressure is then applied and released by means of the three-way cock. Leaks in the hose or fittings are found by an application of soapsuds.

The Potter Trench Machine.

We herewith reproduce from the *Engineering News* an illustration of a new trench machine, for use in the excavation of sewer and other trenches in the streets of the cities, which is being put on the market by the Potter Manufacturing Company, of Indianapolis, Ind. Our contemporary adds:

Most of our readers are now familiar, we presume, with the general operation of trench machines; but for the benefit of any who are not we may explain that in all machines of this class the dirt is excavated from the trench and hoisted in buckets, which are then carried to the rear of the machine and dumped over the completed sewer, water pipe, or whatever may be built in the trench. Thus the dirt is handled but once, and obstruction of the streets by dirt piled in them is avoided. The advantage in this respect is so great, that, in specifications for street work it is common now to specify that trench machines shall be used. Such a specification involves no additional cost to the city, since a contractor saves so much in labor by the use of the machines that he cannot afford not to use them on trenches of any considerable width or depth.

The machine illustrated herewith is of the steel trestle type, as shown by the engraving; and differs from other machines of this type chiefly in the apparatus upon the car. The upper horizontal frame of this carries three cross shafts. The middle shaft carries a brake drum, the bull wheel for the traveling rope, and two drums for the separate hoisting ropes. Each of the other shafts carries a grooved wheel for a hoisting rope. A pulley at each end of the frame supports the traveling rope. This is a steel cable, which starts from the upper drum of the hoisting engine, passes along the trestle and over the traveler, around a tail-block pulley or sheave at the rear end of the trestle,

and returns again to the traveler and passes round the bull wheel, to which it is attached. The other cable starts from the lower drum of the engine, and goes directly to an eye or ring in the front of frame of the traveler. This latter cable holds the traveler stationary while the buckets are being raised or lowered, and pulls it forward again after the buckets have been dumped.

The buckets are raised and lowered by winding or unwinding the main cable on the bull wheel, which, being attached to the same shaft

as the drum, causes the bucket cables to wind or unwind on their drums. The machine is operated by the engineman in obedience to signals given by the man on the traveler. Ordinarily two buckets are handled at a time. The buckets are of steel, with a capacity of ½, ¾ or 1 cubic yard capacity.

The buckets used are either ordinary buckets with drop-bottoms, or a special drop-bottom bucket designed by the Potter Co. It is claimed that it will open and close automatically. A rope may be attached to tip it at any desired point. These buckets are made with a capacity of ½ to 8 tons.

New Economies in Iron Making.

[By Mr. Herman L. Hartenstein, in *Am. Mfr.*]

It has become commonplace to attribute the world's remarkable progress to great inventions. It is none the less true. But invention is now more and more directed to methods of saving and utililizing what have heretofore been considered waste products and unusable energies. For, together with a fuller appreciation of the developments of steam power, the cheapened processes of making iron and steel, the numerous methods of artificial illumination, and the varied uses of electricity, has come the knowledge that all these are extremely wasteful of both materials and power. And a new meaning has attached to the axiom that in the economy of nature nothing is lost.

Human progress has apparently been coincident with growth in the manufacture and use of iron and artificial light. To remove either would practically restore the dark ages. To divide their cost would mean doubling their consumption and an immeasurable increase in their efficiency. It is the object of this article to show how this can be done by means of new and remarkable economies.

A hundred years ago the pine knot, the rush light, the greasy rag, the tallow candle and the smoky oil lamp comprised the principal means of artificial illumination. A hundred years ago the "mud-paved, robber-infested" streets of London were provided with only an occasional lamp or lantern, the chief effect of which was to "make the darkness visible." To-day a single one of the lighting companies of that metropolis has upwards of 10,000 employees. And to-day the electric search light illumines the steamer's course like day, or throws from the 36,000,000-candle power light on Penmarck Point a warning visible 60 miles at sea.

In 1740 the annual consumption of iron did not amount to 1 pound per capita. In 1870 it had increased to 102 pounds; and in 1890, to 370 pounds per capita. In 1910 the United States will probably reach 100,000,000 in population, and with the present rate of consumption, our requirements alone would then be upwards of 10,000,000 tons per annum.

Is it possible to continue this rate of progress? If so, how? No one can foretell the future except by the past. And this justifies greater rather than lesser expectations.

That which to-day seems perfect, to-morrow appears criminally wasteful. The steam engine itself, which has done more for mankind than any other one invention, even in its extreme efficiency wastes more than 85 per cent. of the heat value of its fuel. Is this perfection? The blast furnace consumes 15,000 pounds of substance to produce 2,000 pounds of iron. Is this economy? The coke oven wastes from 40 to 60 per cent. of its gases; and these, together with the tar, ammonia, benzol and other products, it has been demonstrated are sufficient to pay all cost of operation and a substantial profit besides. Many other instances could be cited, but they do not figure in the proposed reduction in the cost of iron and light, and so will not be mentioned here.

On January 4, 1898, the United States Patent Office issued to me three patents, numbered 596,704, 596,705 and 596,749, covering "Processes for Utilizing Waste Products of Blast Furnaces." By methods protected by these patents it is proposed to make extraordinary reductions in the cost of iron and artificial light.

It has already been stated that 13,000 pounds of substance is wasted by the blast furnace in producing 2,000 pounds of iron. By using ore containing 50 per cent. of metallic iron, the following is a practically correct statement:

Consumed.	Produced.
4,000 pounds ore.	2,000 pounds pig iron.
2,000 pounds coke.	1,500 pounds slag.
1,100 pounds limestone.	12,100 pounds gases.
8,500 pounds air.	
15,600	15,600

For every 2,000 pounds of pig iron there is obtained 1,500 pounds of blast furnace slag. This is not only a waste product, but its removal is usually an expense to be charged with the cost of the iron. It has been used to adulterate the cheaper grades of cement, and to manufacture mineral wool, but its success for these purposes has been very limited. It has principally been used as railroad ballast and in street making, but the income from these sources has scarce paid the cost of handling.

Blast furnace slag is composed of from 50 to 55 per cent. of lime, 25 to 28 per cent. of silicon, 16 to 18 per cent. of aluminum, and a small proportion of other substances varying according to the composition of the ore reduced and the limestone employed as a flux.

By using the processes mentioned this slag is combined with carbonaceous material, such as coke, and a new product is obtained which is known as "carbolite." On bringing carbolite into contact with water or other liquid a gas is instantly generated, which, when used in suitable burners, gives a beautiful white flame of great steadiness and remarkable luminosity.

The method of producing carbolite is as follows: Slag, being a combination of all the non-volatile substances contained in the charge except the iron, and being lighter than smelted iron, floats on top, and is drawn off through an aperature in the furnace placed at the upper line of the molten iron into suitable receivers so constructed as to retain the great heat. Being at a very high temperature, it is almost as fluid as water, and by means of great ladles operated by hydraulic power is passed from the receivers into converters similar to those used in manufacturing Bessemer steel.

Except that the tops are somewhat closed, the opening being much smaller than the central diameter, these converters may be likened to great elongated iron kettles hung on hollow shafts or trunnions so as to easily turn or tip. Through these hollow shafts or trunnions iron pipes are run, leading to and connecting with a number of small tubes that perforate the bottom of the converter. These pipes and tubes are so arranged that finely pulverized coke can be fed into and forced through them.

Before the slag is poured into the converter a strong gas blast is forced through the pipes to keep the molten mass from running into and filling them up. As soon, however, as the slag is poured into the converter, the pulverized coke is fed into the pipes and by the gas blast carried through and forced into the molten mass. This is continued until the slag is thoroughly impregnated with the coke. And to insure uniform mixture the converter can be tipped backward and forward as desired, thus increasing the agitation.

When the mixture is complete the converter is turned on its shaft so as to cause the mass to flow between a series of carbon bars or electrodes that serve to introduce a powerful electric current. Coke is an excellent conductor of electricity, while slag is highly resistant. The result is that the particles of slag in connection with the particles of coke form innumerable miniature electric arcs, producing a most in-

tense heat within the mixture. In the course of about 20 minutes the mass becomes so superheated that the slag is deoxidized and becomes fused with or carbureted by the coke. When this fusion is effected the material is finished. It is then poured into moulds of any desired size or shape. When cool it is of crystalline formation, has a metallic glitter, and is nearly twice the weight of coal.

The finished product, carbolite, can be kept indefinitely and transported without difficulty. It is impervious to almost everything except water. Protected by wood-jacketed tin cans from water and atmospheric moisture, it can be kept as a common article of merchandise and supplied to the consumer with much less difficulty than the ordinary illuminating oil. Each pound of good carbolite will produce 5 cubic feet of gas, and each cubic foot of this gas is equal, in illuminating power, to about 15 cubic feet of ordinary coal or water gas.

By a little calculation it will readily be seen that, at $50 per ton or 2½ cents per pound, 35 cents worth of carbolite will produce as much light as 1,000 feet of ordinary gas costing $1. And the same amount of light by 16-candle power incandescent electric lamps at 1 cent per hour each, would cost upwards of $2.

Carbolite gas is equally adapted for use in isolated places or to supply the largest cities. Individual generators are built, which operate automatically and are so simple of construction that even the inexperienced can handle them. Their cost is so moderate that persons of ordinary means can well afford to buy, and it is almost as practicable for them to own their gas plants as to have oil lamps. The best evidence of their safety is that many of these generators have been approved by conservative insurance authorities.

Automatic town and city plants have also been constructed, the cost of which is many times less than of the systems now used. The piping is much less expensive than present distribution, since carbolite gas is unaffected by frost, thus doing away with deep laid or protected pipes, and the quantity consumed is much smaller than of ordinary gas. The cost of maintenance and operation of the generating plant is almost nominal, no heat or expert attendance being required. And no town or village is now too small or too poor to afford its own gas plant, especially one providing a light unsurpassed anywhere.

It is equally practicable to light individual blocks or buildings in the larger towns or cities, no franchise being required where public thoroughfares are not used, and no alterations of existing fixtures being necessary except an inexpensive change of burners.

The superiority of the light cannot be appreciated except by actual visual test. The flame is as stable as a piece of metal, the flickering of ordinary gas flame being entirely absent. The very noticeable odor of the unconsumed gas is a safeguard against asphyxiation. And the small volume required not only greatly reduces the danger of asphyxiation, but gives marked relief from the heated and stifling products of combustion which vitiate the air to an almost unbearable degree where ordinary gas is used extensively. In short, carbolite gas is unequalled in cheapness and unsurpassed in safety and quality.

The construction of a carbolite plant is almost identical with that of the Bessemer portion of a steel plant, except that electrical heat is also used. The converters can handle three or more tons at a single charge, being manipulated by hydraulic power as are also the cranes and ladles. In fact nearly all of the highly developed mechanism of the modern steel plant is directly adaptable for the manufacture of carbolite.

The most favorable conditions for the production of carbolite would be in connection with the manufacture of pig iron and coke. In a combined plant not only could the slag of the blast furnace be made valuable, but the immense volume of gases from the furnaces, converters and coke ovens, together with the now wasted sensible heat, could all be transformed into mechanical energy ample to provide for all power requirements and without the expenditure of a penny for fuel. The famous water power of Niagara cannot compare with this for cheapness. For with fuel furnished without cost, water power cannot compete with the steam engine or gas motor.

Placing the cost of carbolite at $10 per ton, and crediting to the blast furnace, in return for its slag, waste gases and heat, the difference between this figure and the actual cost, let us see what effect this will have on the cost of pig iron.

Assume a 300-ton blast furnace located in the Pittsburgh district, where coking coal, limestone and ore can be assembled at the greatest advantage. Each ton of pig iron requires about one ton of coke for reduction from the ore; therefore 300 tons of coke will be required for this purpose. As previously stated, there are about 1,500 pounds of slag produced with each ton of iron, which would mean a daily output of 225 tons of slag. One ton of slag is sufficient for one ton of carbolite; but allow that the above daily output would only supply a 150-ton carbolite plant. For each ton of carbolite 800 pounds of coke is needed; but, to be safe, allow 1,000 pounds or 75 tons daily. This, added to the 300 tons for the blast furnace, would mean a daily requirement of 375 tons of coke. About 1½ pounds of coal will make 1 pound of coke, so that it would take 562 tons of coal for the 375 tons of coke—a total daily consumption of 937 tons of coal and coke.

A company, controlling such an extensive plant, would undoubtedly own its coal mines and use the latest improved by-product coke ovens, and should furnish coke at a good profit for $1.50 per ton.

Under the above favorable conditions the profit on iron and coke would take care of the investments in those parts of the combined plant, not considering the additional profit arising from the sale of slag, waste gases and heat to the carbolite plant. We may therefore ignore the investments in the combined plant except that in the carbolite plant itself.

A 150 ton carbolite plant would cost not to exceed $150,000, and would require approximately 3,500 horse power. The following is a liberal estimate:

Daily Cost of Operation.

Material:		
75 tons of coke at $1.50		$112.50
Power and Electrical Plant:		
1 Chief Engineer	$5.00	
2 Engineers at $3.50	7.00	
1 Electrician	3.00	
1 Machinist	3.00	
2 Helpers at $2	4.00	
		22.00
Slag Plant:		
1 Superintendent	$5.00	
2 Assistants at $3.50	7.00	
1 Chemist	5.00	
6 Slag charges at $1.75	10.50	
2 Converter men at $3	6.00	
8 Ladle men at $1.75	14.00	
30 Laborers at $1.50	45.00	
4 Stock keepers at $2	8.00	
		100.50
Repairs and Incidentals		27.50
Total cost of 150 tons of carbolite		$262.50
Average cost of 1 ton of carbolite		1.75

The cost of the power and electrical plant is included in the cost of the carbolite plant. No allowance is made for fuel, as heat will be derived from the sensible heat of the waste substances and from the combustibles in the waste gases from the combined plants, and can be used for making steam, or in gas motors, or by both combined. Even should 5,000-horse power be required, it can easily be obtained from these sources. For, as it takes about 1.5 pounds of coal to make 1 pound of coke, it would take 562 tons of coal to make the 375 tons of coke; and 15 per cent. of the heat contained in all this fuel would be ample to provide 5,000-horse power, while over 30 per cent. would be available.

The output of a 300-ton carbolite plant, working 300 days in the year, would be 45,000 tons. It has been shown that with carbolite to the consumer at $50 per ton, its gas will furnish a superior light at a far less cost than any other. But placing the price at $20 per ton to the dealer, thus leaving to him a $30 total margin of profit, a gross income of $900,000 would be produced for the manufacturer by a single 150-ton plant. Cost of production and disposal is estimated as follows:

Manufacturing cost, 45,000 tons at $10	$450,000
Packages, 45,000 tons at $2	90,000
Salaries, office and all other expenses	50,000
Depreciation of plant	10,000
Profits on investment, 200 per cent	300,000
	$900,000

It has been shown that the actual cost of manufacture is $1.75 per ton exclusive of the charge for slag, waste gases and heat; leaving a margin of $8.25 to be credited to the blast furnace for each ton of carbolite made. As one ton of carbolite is manufactured for each two tons of iron, one-half this amount, or $4.12½, should be credited to each ton of pig iron in addition to the usual profit. The average price per ton for pig iron in the United States for 1897 being $9.45, it will be readily understood that by this process the cost of pig iron will be practically reduced one-half.

It is entirely probable that the pig iron output of the United States 1898 will exceed 10,000,000 tons. If this could be made by the process

described, a saving of more than $40,000,000 per annum would be effected, certainly enough to revolutionize iron making.

The question next arises whether there would be active demand for the vast quantity of carbolite produced. Artificial illumination alone would create an immense demand, and the use of carbolite gas for heat and power purposes would be even greater. The opportunities for the use of the gas are almost without limit. Its lesser uses are sufficient to revolutionize important industries. From it ether can be made for one-tenth its present cost. Alcohol has also been manufactured from it in quantity, the process being the subject of a special series patent; and the Commissioner of Patents has made personal request for samples of the alcohol for the Government's exhibit at the coming Omaha Exposition.

To go into further detail as to the numerous minor uses of carbolite would confuse rather than enlighten. While the results that can be accomplished are sensational, the methods employed can readily be understood by any intelligent person. And while carbolite itself is a new product and the processes by which it is made are entirely original, yet similar products are being made by crude and expensive methods; so that its entire practicability has, by actual use, been demonstrated beyond any question. No mystery or complication is involved, and important ends are attained by commonsense utilization of ordinary substances now going to waste.

This is not a mere theory, or an impracticable idea or simply a demonstration on paper. A practically new steel plant, erected at a cost of upwards of $100,000, has been purchased and adapted to the production of carbolite. It will have a capacity of 50 tons daily, and at present lacks only its electrical equipment which is in course of construction. And within a comparatively short time the plant will begin the manufacture of carbolite on an extensive scale.

The Engineer in a Coal Mine.

By Mr. Geo. H. Ashley, of Stanford University.

In coal mining, as in most enterprises of exploitation, it is often true that within narrow limits mining may be carried on profitably with but little or none of the knowledge possessed by a trained engineer. In coal mining, as in the mining of metals, these limits may be very narrow or quite broad, according to the quantity and quality of the mineral being mined. Thus, mining may be carried on with profit in an 8 or 10-foot bed of first class coal with but little knowledge of engineering principles, while in a 3-foot bed only the constant application of such principles will make the mine a paying one. Again, a mine may often be worked on unscientific principles for a few years with profit, but after a certain extent of work has been done it may become unprofitable. The question naturally arises as to the nature of engineering work in a coal mine. I shall not attempt in the limits of this article to enter into details in answering that question, but taking the conditions within the narrow limits of the Indiana coal field, with which my present work has made me more or less familiar, merely suggest some of the engineering problems found.

Let us suppose, as is usually the case, that our engineer is connected with a company that is operating several mines. Let us suppose that after some preliminary drilling the company has acquired some hundreds of acres of undeveloped coal land. His first work in connection with the new mine will be to obtain the topography of the coal bed, if possible. Under his direction one or two drilling crews will drill over the new territory as thoroughly as the conditions require. With his immediate assistant he will make the necessary surveys which combined with his drilling records will enable him to construct a topographic map of the coal bed. This shows him in a general way the slopes or dip of the coal, and from it he will determine the location of the shaft, the main entries and the drainage. He may have to decide between the advisability of working the whole territory from one shaft or from more. When two or three beds are to be worked, the preliminary laying out of the mine may be a very delicate question, involving the whole success of the mine. Should all the beds be worked at once, or one bed at a time? If the latter, which one? If the former, will one shaft with several landings be used, or could a saving be made by the use of drop shafts, or tunnels from one bed to another?

In opening and laying out the mine there must be taken into account not only the topography of the coal but the general mining method which it is planned to use, the system of haulage planned, whether machines will be used or not, etc. Next he superintends the sinking of the shaft, the erection of the tipple, engine houses, ventilating fans and other buildings and machinery, much as an architect supervises the erection of a building. A switch must be laid to the nearest railway, a telephone line run to the company's central office, perhaps blocks of houses and larger boarding houses erected for the miners, the water supply for the engines must be attended to, and a host of other details.

Nor must it be supposed that his work is finished when the mine is laid out and started. As with the other mines under his charge, he must plan entries and rooms; he must keep an accurate survey and map of the mine as it progresses, and similar routine work. But he will find his principal occupation in meeting and surmounting the many obstacles daily arising. He may find that the action of the roof or under-clay when practically tested will require an entire change of plans in the manner of working the mine; or it may be only locally that the under-clay will "creep," or a change in the roof require a changed treatment. Every now and then the coal comes to an abrupt end in an advancing entry. He must determine the cause, if possible. It may prove only a narrow preglacial channel of little moment, or it may prove a broad cut-out or a fault of many feet down-throw, or some other irregularity requiring an entire change in the laying out of that part of the mine. These are only suggestive of some of the many problems constantly arising and requiring his training and good judgment in obtaining their best solution.

Then, again, his skill and knowledge are required in still another direction, namely, in the preparation of the coal for market, the determination of the uses to which the coal is best adapted, the utilization of waste products, and many similar problems. This may mean the installation of improved screens, a washing plant, a coking plant, perhaps a plant for the manufacture of coal briquettes, the preparation and marketing of the under clay, and many similar enterprises that in these days of close competition may make all the difference between success or failure.

III.—Anxious Moments in a Gas Manager's Day.

By an "Old One," in *Gas World*.

The Charge must Suit the Coal.—Stoppages caused by the accumulation of filthy matters in the ascension pipes or in the hydraulic mains are to some extent a question of neglect, as regular attention to the augur and clearing bars, together with a periodical flushing out and clearing of the hydraulic and foul mains at least once a year, will do more in the way of preventing trouble from these causes than any of the remedies that have been freely advertised from time to time. Obstinate and long-continued attacks of the malady may be due to working charges that are too light or too long in duration to suit the quality of coal used. There is too much faith, in the majority of the smaller class of gas works, in the fetish of the 6-hour charge. In larger works the generator furnace and inclined retort have led to the use of shorter periods, but many of the older class of gas works' laborers and foremen have never heard of 4 or 5 hour charges. The 6-hour charge is a very good arrangement so far as the convenience of the men is concerned, bringing every charge at a regular even hour each day. But that it is suited to any and every class of coal is not so easily proved. Some of the coals that have a bad name, as certain to cause choked ascension pipes if used, really possess the quality of working off more rapidly, and with a less absorption of heat, than others—points that should be regarded as a recommendation rather than otherwise. If the circumstances of working are such as to render the retaining of the 6-hour charge desirable, even at the risk of loss in other ways, then it is worth while taking some trouble, in the way of securing coals that are suited to the system. People sometimes persist in working 5 hour coal for 6 hour charges and then complain of being unfortunate in the matter of chokes.

The weight of the charge should be dependent upon the size of the retort, and it is a mistake to suppose that it can be regulated to suit the number of hours that it can be left in the retort. Both overloading and underloading the retorts may lead to chokes. The coke should be drawn, not at six hours or at any other period suited to the convenience of the retort house hands, but as soon as it is worked off. If allowed to remain longer, as is the case when the 5-hour coal is left for 6 hours, the last hour is chiefly devoted to cracking and scurfing up the retort, and to getting the ascension pipes up to a temperature that will assist in producing chokes when the next charge is put in. A certain sympathy is noticeable between the causes that lead to the deposit of carbon in the retorts and to the deposit of pitch in the ascension and hydraulic. Trouble in the retort house may also be due to defects further on. If the outlet pipes leading to the condenser are permanently too small, by reason of defects in design, or temporarily so by reason of deposits of pitch or naphthaline, to afford a free outlet for the large

volume of gas, water vapor, and partly condensed tarry matters, the conditions that favor the formation of chokes are encouraged. So, to a large extent, the remedy of this class of troubles is, or should be, in the manager's own hands.

Waterlogged.—A large quantity of pitchy, oily and aqueous liquid is deposited between the retorts and the condensers. If all is in order, these should flow away into the wells provided for their reception, by virtue of their own gravity, leaving a clear and unimpeded passage for the gas through the various siphon seals and outlets that are provided for that purpose. These are frequently supposed to be automatic in action, and quite capable of taking care of themselves for years at a time. But they are occasionally the cause of much trouble and loss, by reason of faulty design in the first place, or on account of their not being so located as to work to the best advantage. I have insisted on the necessity for cleaning the interior of the hydraulic mains at least once a year; and the same applies with equal force to every seal box throughout the works. Clots of pitch, dust, dirt, etc, settle in the bottom of the box, especially when the flow through is a mere dribble, and these gradually settle and cake into a compact mass that will stop the passage of every liquid as effectually as an indiarubber plug. It may happen that portions of the deposited matter become so thick and pitchy before they reach the outlet that they will not flow through it as they are supposed to do; and in this connection it is well to remember that the siphon should be situated, as far as practicable, in a sheltered, warm locality. If the condensed matters are exposed to heat in quantity sufficient to distil off the naphtha and lighter constituents, as obtains when the hydraulic is too close to the settings, a partial fractional distillation takes place, and leaves a viscid, semi-solid residue. A similar effect may follow, though from different causes, from exposure to cold; so that the condensed matters should not flow from a warm to a cold spot. There should be an outlet from each hydraulic, leading, in as direct a line as possible, to the tar well, to take off the heavier, first deposited matters. If there is a foul main, an outlet from it, situated also inside the retort house, may be connected up to the same pipe. This done, a great step in the way of avoiding trouble from pitch at a subsequent point, or in the condensers, is effected, and it is well to avoid too many siphon outlets. Some gas engineers, with the laudable object of keeping the pipes clear, put on a siphon outlet at every 10 yards or so. If everything is carried forward to the condenser inlet, which is, perhaps, situated in the open air, trouble may be expected, particularly in cold weather. But if there are so many seal boxes that some do not have more than a few gallons per day passing through them, they become settling boxes instead of safety outlets. A good flow of liquor through a siphon is to some engineers a guarantee for keeping it clear; and in many works it is possible to arrange, without much trouble, for flushing the whole with ammoniacal liquor, by means of a service laid on from the rising pipe to the scrubber. This plan can be readily applied if the number of siphon seals is reduced, by arranging for one seal to receive three or four pipes. Simplicity in attention to keeping in order is thus greatly facilitated; and all siphons should be fitted with air-tight covers, to keep out dust.

A Night Experience.—Sometimes the levels, or the position of the tar well, are such that all the siphons cannot empty by gravity, but must be pumped out by hand; or some of the gas pipes are so low as to be flooded if the well gets full. This necessitates regular attention and watchfulness. Not only must a reliable person be told off to attend to the pumping, but he should gauge the depth of liquor in the receptacle each time, both before and after applying his pump. This applies also to gasholder siphons, and to everything situated on what we may call a principal line of gas main. The night foreman, on one occasion, roused me during the small and early hours with the startling news that the gas would not get away from the retorts; and, sure enough, the retort house was full of flame and smoke, while the condenser and scrubber seals were spluttering energetically, and the men in a state of consternation. A rapid inspection showed that all was right at the purifiers and gasholders; but the gauge on the exhauster outlet was blown out, which at once located the source of the trouble. The connection between the exhauster and the purifiers included a long run of pipe rising from a low to a high level, and at the lowest point was an ordinary street siphon or drip box. This was pumped regularly by the foreman himself three times a week, and he was sure he had not neglected this duty, but thought there had not lately been so much liquid from it as usual. He at once put the pump on, and extracted a few bucketsful, pumping as long as anything would come. But on taking the pump off, and putting a rod down the suction pipe, a depth of 4 feet of liquid, sufficient to flood the gas main for several yards, was discovered. Investigation showed that the threads on the suction pipe were badly corroded, and that, while they admitted a short lift, directly a lift of a yard or so was reached, sufficient air was drawn to block the pump. A new thread was cut, and the pump put on and firmly secured; and over 50 buckets of light tar and water were then extracted. When half this quantity had been reached the gas began to pass and things soon assumed their normal position. The man at fault propounded a most ingenious theory about the liquid being bayed back in the pipes; but it was evident that he had simply tried the pump in a careless off-hand way, and the liquid had gradually accumulated till it blocked the gas way completely. He was cautioned to be more careful, and always to make sure that he cleared the siphon, and there would then be no more baying back. And there never was, although some years elapsed before the arrangement could be replaced by a self-acting one.

How to Avoid Blocks.—The drip outlets from the purifier connections and valves are particularly liable to get blocked, owing to the risk of washing fragments of purifying material down the inlet pipes. If a center valve is used, having a draining well below in which a small pipe from each compartment is sealed, we know at once where to look if some of the purifier lutes blow. There should be a small plug hole in the cover of the valve just over each pipe, so that a rod can be inserted to clear it without interfering with the make of gas. The use of small wrought iron pipes in connection with any draw-off arrangement is objectionable. They are acted upon by foul gas and ammoniacal liquor, and when partly rusted afford an easy hold for clots of pitch, particles of purifying material, or any foreign matter. I have several times had trouble from accumulations of water in the purifier connections, which are very difficult to deal with during the hours of darkness. The best remedy is to see that there are no runs of pipe that can become waterlogged, or if such cannot be avoided to arrange proper means of draining them out. The outlet from the washer is also particularly liable to be blocked by liquid carried over with the gas, if such cannot get away freely.

It would be possible to go on indefinitely with reminiscences of difficulties caused by water in the wrong place. They belong to a past rather than to the present era, for the ample sized connections which are now usual in all properly arranged works go a great way towards neutralizing the effects of such accumulations if they do occur. Instances could be quoted where 6-inch connections were considered quite large enough; but not less than 12 inches would be put down now. And a quantity of water sufficient to block a 6-inch pipe would not half fill a 12-inch one. Nearly all the difficulties due to blocking of pipes by condensed matters can be avoided by observing as much simplicity as possible, avoiding bends, curves, etc., where such can be done, and giving all pipes a good fall to the outlet; by seeing that the outlet is free, and not liable to back passage, by substituting 3-inch cast pipes for ¾ inch or 1-inch wrought iron, and by regular care in the matter of flushing or cleaning.

It seems unnecessary to refer at length to stoppages due to deposition of naphthaline about a works, since the circumstances leading to that trouble are now well known. With a sufficiency of foul main to give the gas a slow and gradual evolving, no difficulty is likely to arise. But it may be worth while to mention than an obstinate case of stoppages between the purifier outlets and the holder inlets, sometimes before the station meter, sometimes at the outlet and sometimes in the holder inlets, was completely cured by sprinkling the contents of each purifier, immediately before pulling down the cover, with a gallon or so of naphtha, by means of an ordinary watering pot. Steam had been applied but it had only effected a temporary clearance, and had also caused the inlet pipe to leak, so that several gallons of water were pumped out each day. This trouble disappeared when the steaming was stopped. Light tar oil, or "first runnings" from the tar distillery is also a useful thing to have on the works, for dissolving either naphthaline or pitch.

Correspondence

[The JOURNAL is not responsible for the opinions expressed by correspondents.]

Questions Frequently Asked Concerning Inclined Retorts, with Answers.

NORFOLK, VA., April 28, 1898.

To the Editors AMERICAN GAS LIGHT JOURNAL:

Question 1.—Have "Inclines" been used preferably to horizontal settings? If so, where and to what extent?

Answer.—In the AMERICAN GAS LIGHT JOURNAL, Nov. 23d, 1896, page 803, will be found a list of 16 works in England using "Inclines."

Several works have been added since, notably at Leeds, where a block of 26 benches was erected; and as the "Inclines" commonly used are equal one bench to two of horizontals, it will be seen that this is an installation of considerable magnitude.

Of the works named at that date, the plant at Brentford is reported (*vide* "Field's Analysis" for 1896), to have made 1,433,880,000 cubic feet of gas during the year. The "Inclines" were introduced at Brentford, by Mr. Frank Morris, Engineer of the Company, who was ably seconded by his Assistant (now his successor), Mr. J. Husband.

The Company was so well pleased with the results obtained from the "Inclines" that the Chairman (or President) referred in most complimentary terms to Mr. Morris in connection therewith—this in August, 1897; and Mr. Morris was afterwards added to the Board of Directors.

In a recently published annual report of Herr Emil Merz, Director of the City Gas Works, of Cassel, Germany (see *Journal für Gasbeleuchtung*, page 187, issue of March 12, 1898), he gives the names of 16 works, not including any in England, where inclined retorts are used. His list shows a total of 2,457 retorts on the inclined plan, not including his own works or those of the Municipal Works at Berlin, Rheims and elsewhere. Nor does he mention the latest addition of those falling in line with the "Inclines"—viz.: The 3,500,000 cubic feet per 24 hours' works, erected at Schlieren, on account of the municipality at Zürich, a city of 90,000 inhabitants.

Even at Birmingham, England, where eight years ago the "Inclines," in their then imperfect state, were failures, for the same reason that ours at St. Louis were, "Inclines" have again been recommended to be used in preference to horizontals, in the very considerable extensions to the gas plant of that city about to be put up.

The extent to which "Inclines" are now used may be seen from these statements. There are works with but one bench of "Inclines;" others with from 26 to 70 benches of 6's, 7's and 8's, also 9's, with retorts 15 to 20 feet long.

Question II.—Are "Inclines" used exclusively at any gas works, and, if so, how long have they been thus used, and are they giving satisfaction?

Answer.—Yes; "Inclines" have been exclusively used, for instance, at Cassel, Germany, since December, 1894; and the installation then started has been increased.

The "Inclines" were chosen by the engineers appointed by the municipal authorities of Vienna, Austria, when they decided to erect their own gas works; and the success with which the "Inclines" worked at the Imperial Continental Company's station in that very city was pointed out to me by the Director of the city gas department, Herr Herman, and said to be one reason why "Inclines" were preferred over horizontal retorts and stoking machinery. These works are to have "Inclines" only—1,620 retorts in one great retort house.

As much of the success of the "Inclines" is due to the persistent, intelligent study of the system, by Mr. Edward Drory, formerly Chief Engineer of the Vienna, but now Chief Manager of the Berlin works of the "Imperial Continental Gas Association," of London, England, his name should be held in honorable remembrance by all gas men everywhere. Mr. Drory's design has been largely copied; and though he never failed to give Mr. Coze all the credit he deserved, Mr. Drory was seldom remembered and merited as he should have been; but it is not yet too late for that.

If I mistake not, "Inclines" are exclusively used at Brentford, and also by the Salford Corporation gas works. At both works they may have some horizontal settings left over; but "Inclines" are certainly used exclusively.

At Salford, which, according to published reports, made over 1,243,531,000 cubic feet of gas in 1896, the "Inclines" were so much preferred that the Corporation stood a lawsuit on account of them rather than stop their use. By-the-way, the Corporation lost the suit in question.

The Engineer of the Salford Corporation, Mr. S. Y. Shoubridge, has since been appointed Engineer of the Crystal Palace District Gas Company, London, by Mr. Geo. Livesey, so eminent in British gas circles. This promotion was largely due to Mr. Shoubridge's success at Salford.

At Huddersfield they have a coal gas works of about 4,000,000 cubic feet capacity per 24 hours, and only "Inclines" are used there. The successful former Engineer of the Huddersfield Corporation (Mr. W. R. Herring) has since been promoted to be the Chief Engineer of the Edinburgh and Leith Gas Corporation; and at all these works "Inclines" have been in use a number of years.

Question III.—Is coal coked as thoroughly, and is the yield of gas of as good quality, and of as much per pound of coal, as if done in horizontal retorts; and does the time required to do the work exceed that when done in horizontal retorts?

Answer.—Coal is coked as quickly and as thoroughly in inclined retorts as in horizontal ones. And the testimony of all the engineers I interviewed upon the subject was that in quality and quantity the gas made by the inclined system is the same as if made in horizontal retorts. But the coke made with inclined retorts is slightly better, in that it is more solid, and not as much breeze is produced, owing to less breaking up of the coke when discharging retorts. This must be self-evident to any one who will consider the subject.

Question IV.—Can as much gas be made per lineal or square foot of retort "in fire" by the "Inclines" as by horizontal retorts?

Answer.—The retorts of the inclined type can be charged with as much coal per foot of retort as can horizontal retorts; and as the coal is coked as fast, and a like quality and quantity of gas obtained from the coal used, it follows that one 18 or 20 foot inclined retort can, and does, turn out as much gas per given time as two horizontal retorts of respectively 9 or 10 feet in length would do.

Question V.—Will a bench of "Inclines" last as long as a bench of horizontal retorts, if operated under like conditions?

Answer.—I have seen inclined retorts which had produced over 15,000,000 cubic feet of gas still in use. Many benches which I saw had been used 800 days and more, and were in good condition. In fact, engineers who had used both the horizontal and inclined settings for years said the "Inclines" lasted longer, because they were not subjected to the abrading action of drawing rakes and the pounding of charging scoops.

Question VI.—Concerning manipulation. What, if any, advantages are presented to the favorable consideration of both operator and company, employer and employed, to using "Inclines" instead of horizontal settings of retorts?

Answer.—Perhaps an incident from my own experience will serve to answer that question in part: In 1884, the retort house men of Laclede gas works, St. Louis, Mo., demanded some relief from their very hard work. The spokesman, a big, brawny Irishman, by name of Carey, stated that the work of a retort house fireman was so exhausting that often, when the day's work was done, even the best of food would not tempt the appetite, and that no matter what pay a man got he could not make full time all the year round. That at a time in life when men in other lines of work were still at their best the retort house fireman had to give up, and try for such work as he might still be able to do, which often could not then be found.

The demand of the men was met by giving them extra help, which satisfied them at the time; but a few years after they struck for an eight-hour day, with the usual result to men and Company. I have (and some of you may have) seen men die from the terrible strain on the human system when exposed to the heat and physical hard work of ordinary, daily retort house routine. Now, with the advent of the "Inclines" all that is changed. Any man who can work at sweeping streets can be taken from that kind of work to discharge gas retorts, and the charging is simple, compared to filling an ash cart. Now the retort house man who after years of hardship is at last obliged to give up and go on the streets, if he can get a job thereon, need do so no longer—if his company has put in inclined retorts meanwhile; for he can stay right on where he was, in the retort house, and be employed at better wages and with greater advantage to himself and to the company.

When the "draw" is done with the "Inclines" he will not have to hunt for a cool spot to catch his breath; but, for instance, if it is a small works, he will reluctantly leave the retort house to return to the lime kiln or purifying house, to finish the task he gladly left, when "slacking out" time came. If it is a large works, the company will not have to figure if, owing to trouble to get men in hot weather, and greater cost anyhow, it would not be better after all to make water gas.

The inclined retort evens up the labor question as between water and coal gas amazingly; and water gas manufacturers would in most cases make money by putting in an inclined retort generator to make their own coke, instead of buying that article or expensive anthracite. With a suitable bench, the gas maker could, *between times*, make the coke needed.

Thus it will be seen that the "Inclines" possess advantages for the laboring man as well as the gas company. Skilled labor, such as must be used when stoking machinery is employed, is not required with "Inclines." Any man intelligent enough to shovel coal into a pile can operate the inclined retorts. Therefore it is evident that this system is to be desired by all classes interested in gas works manipulation. Indeed, in England I was told that the men would not voluntarily

return to the old way of working, and considered it a favor when sent to the inclined retort benches.

Question VII.—Is there any special machinery required to properly operate inclined retorts, or can they be worked to advantage without machinery?

Answer.—"Inclines" can be worked to advantage either with or without machinery. This must be patent to anybody who will give the matter a thought, for in any case the loading or unloading of the retorts is done by the power of gravity, whereas in either manual or machine work this cheap aid to human progress cuts no figure at all; but much will depend upon the magnitude of the plant where it is proposed to use "Inclines." In a small works, where perhaps never more than two benches are in use at the same time, it would probably be better to build a runway, and wheel the coal upon the charging stage and dump it into the retorts from the wheelbarrow; but if four or more benches were the minimum number in fire, a coal breaker, bucket elevator, conveyer and elevated coal bin, such as are used at large works where stoking machinery is used, would no doubt be the proper thing to add to the retort house equipment.

Those desiring to install "Inclines" at their works can have a choice from a number of tried and successful methods for handling the coal and coke. For a new works it is easy to decide what is best; but for an existing works, it would be best to carefully consider known methods, and then select the one most adapted to the existing conditions.

Question VIII.—What is the cost for repairs when using the inclined retort system, including all machinery required?

Answer.—It costs no more to reset a bench of "Inclines" than a bench of horizontal retorts of like dimensions; and as the retorts last at least as long or longer, that item of expense is easily estimated by the experienced gas manager.

As to machinery, the following will be interesting: In the annual report quoted in reply to the first question the gentleman states that he had not yet had enough repairs to enable him to tell how much per 1,000 cubic feet these would come to; and as the works had then been in operation about three years, that item could not have been a heavy one. From the statements made both in print and verbally to myself by managers who had used all methods of coal gas manufacture, the inclined system will stand favorable comparison with the best of any other system as to cost of repairs.

Question IX.—Can the "Inclines" be used in existing retort houses; if not, what changes would become necessary?

Answer.—The main consideration in connection with this matter is, "Is the existing retort house high enough?" That can perhaps be best answered by stating how much higher a bench with inclined retorts is than one with horizontal retorts. Let it be understood that a bench of inclined retorts, with these set at an angle of 32° and 15 feet 6 inches long on the slope, will occupy but 14 feet 4 inches about, on the level, and will be about 7 feet 6 inches higher than the horizontal set. But bear this in mind. The hydraulic main on the "Inclines" is set on the lower end, so that if you now have 7 feet 6 inches above the brickwork of your present bench, a bench of "Inclines" of the description named can be set in place of it. And remember also that such a bench will make about as much gas in 24 hours, as two benches, set back to-back, of like dimensions of retort would make. That is to say: "Inclines" 15 feet 6 inches long on the slope will be nearly as productive as two benches with 9 feet retorts set back to-back would be. A bench of "Inclines," with retorts 20 feet long on the slope, will occupy only 17 feet on the level of floor space; but will be 10 feet 8 inches higher than a bench of horizontal retorts would be. So it is seen that, while the "Inclines" take up much less room on the floor of the retort house than horizontal retorts of equal producing capacity, they are higher, according to the angle of inclination and length of retort used.

The successful inclined benches of 9's used at Vienna are about 27 feet high, from foundation to extreme top. The 20 feet "Inclines" at Salford, England, are 38 feet 2 inches high, from foundation to extreme top. Both of these designs have full-depth regenerative furnaces. If half-depth furnaces, ground floor firebar furnaces, or, perhaps, the "Flemming" style of furnace were used, the benches would require correspondingly less head room. I have seen a Coze bench, fired in the old way, with fire grate furnace, standing in a retort house formerly used for benches of 3's, and it had room enough.

Another consideration is, how much of an overhead coal bin you will use? Sometimes the capacity of an existing retort house can be doubled, with little additional expense, by placing two rows of "Inclines" into it, near the walls, so as to discharge correctly into the coke yard, with coal bin between the stacks, and partly built up between the roof trusses. Again, the stack may be put with the charging end near one wall of the existing house, and the overhead coal bin placed on supports outside of the same. In this case, if the house is high enough to accommodate the bench, nothing need be done to the building, excepting to suitably arrange the floors; and in a small works, as previously indicated, all that may be necessary would be a platform and runway to wheel the coal to the retorts.

A design for an entirely new retort house, with inclined retorts 20 feet long and overhead coal bin to hold 48 hours' full supply between double rows of benches, required walls 60 feet high from foundation to under side of tie rod—this, if a Fink pattern roof truss were used. A steel arch roof for the same size plant would cost less and look better, and require only walls 20 feet high. The same arrangement of benches could be applied to some existing retort houses which I have seen, if the coal bins were made to hold only 24 hours' supply, which would be ample.

Question X.—Granted that the operating expenses with the "Inclines" are much less than with horizontal retorts, also, that the cost for repairs is less; how does the first cost of such benches compare with horizontals of equal, substantial, design and construction?

Answer.—An eminent gas engineer remarked to me recently that he understood the inclined bench cost three times as much as a horizontal bench. I ask you to call to your aid your own commonsense, to say why this should, or could be true. The inclined bench though higher is much shorter than the horizontal bench, and for 20 feet of slope will surely not require more brickwork than if that 20 feet of retort were set on a horizontal line; and as the 20 feet retort is equal to at least two horizontal benches with 10 feet retorts each, set back-to-back, and requires only one set of ascension pipes, etc., etc., and one furnace, *why* should it cost three times as much as a horizontal bench? It is evidently unreasonable to suppose so.

I have erected inclined benches with retorts 11 feet 6 inches long, which cost less than present contractors bid to put up bench for bench horizontals with an equal number, but of 9 feet retorts.

I do not know what the owners of the Coze patents may desire to charge for royalty, but they certainly will not put such a price upon the "Inclines" as to prohibit their use. Manifestly that would be contrary to their interest to do; but as to the cost of the "Inclines" by themselves, one such bench, equal to two benches with horizontal retorts, will scarcely cost more than these, with all the advantages of the system thrown in. Therefore, when comparing the prices of horizontal and inclined benches, the relative producing capacity should also be taken into due consideration. One would not, for example, expect a bench of 6's to cost only what a bench of 3's would cost.

If a builder would charge me $3,200 for a retort bench with horizontal retorts 9 feet by 14 inches by 24 inches, with a full-depth regenerator furnace, and would offer a bench of inclined retorts, containing the same number of retorts, with the same average cross-section and the same style of furnace, but with retorts 18 feet long instead of only 9 feet and charge—just for example—$6,400 for that bench, I certainly would take the latter; because, to begin with, I would be paying no more for the bench—producing capacity considered; and I would have the great additional advantage of being able to produce my gas at about one half the cost for manipulation that the former system offers, with other advantages I will not again enlarge upon. But I cannot state definitely what such benches will cost. I have stated relatively what such benches are worth compared with the old time horizontal settings. For further information you should ask those who build the benches.

Permit me to make a few remarks upon this subject of "Inclines" not covered by these questions, which latter I have tried to answer, and trust I have succeeded in the attempt to the satisfaction of the reader.

No other improvement in coal gas making ever introduced has presented greater financial advantage to the gas manufacturer than that offered by the inclined retorts. They have been operated for a number of years, upon a large scale, in dozens of works in Europe. In his address, at a recent informal meeting of Scotch Gas Managers, Mr. Hubert Pooley, of Dunfermline, who presided, said: "I had an experience of M. Coze's first system of 'slopers,' when I was serving my articles; but since those days very great improvements have been introduced, and I think I am correct in stating that to-day, for economy of production, they stand unrivaled."

This system has been seen and favorably commended by such well-known American gas engineers as Mr. Eugene Vanderpool, of Newark, N. J.; Mr. J. B. Crockett, President of the American Gas Light Association, and of the San Francisco Gas Company; Mr. A. H. Barret, Engineer of the Louisville Gas Company, and a number of others.

The President of a manufacturing company, doing a large business in America and Europe, wrote to me March 1st, last, as follows, concerning the "Inclines:"

"I have many times been surprised to find that inclined gas retorts have not been introduced and adopted in America while used so largely abroad. The subject has been brought to my attention by learning that the management of one of the large gas companies of London was subjected to severe criticism for neglecting to use this most improved method for the manufacture of gas."

The subject has been brought before the gas industry at large and individually in what was described "In an intelligent and exhaustive manner," and large sums of money have been expended in the effort to introduce the system here; and yet at this date there is not a single set of "Inclines" in operation or course of erection in the United States, or in America, for that matter.

The successful operation of the inclined retort system in England and Continental Europe for some years past cannot be denied truthfully. It is an established fact, which no amount of contradiction can destroy.

Why, then, a system at once so simple and promising such advantages to the gas industry as this should meet with such scant appreciation by the people who are in the business for the money there is in it, is a question which I am not prepared to answer just now.

Yours truly, FREDERICK EGNER.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

MR. W. S. RATHELL has resigned the superintendency of the Decatur (Ills.) Light, Heat and Power Company, in order to accept the management of the properties controlled by the Waco (Texas) Gas Company. That Company operates the electric lighting service of Waco, and the street railway, known as the Citizens Railway Company, as well.

A CORRESPONDENT writes us that papers incorporating the Citizens Gas Company, of East St. Louis, Ills., have been filed by Messrs. Joseph T. Donovan, John M. Sellers, French R. Sessions, Jno. B. O'Meara and Henry L. Cornet, all residents of St. Louis, Mo. The Company is capitalized in $100,000. Our informant adds that their application to the Council of St. Louis for a 50-year franchise has been endorsed, and that work under the grant will be started as soon as possible. The grant among othor things specifies: That the Company shall have the right to manufacture and distribute gas for a period of 50 years; that the plant must be completed within 24 months; and that location of the works must be approved by the Council and the Mayor. It is also declared that selling rates per 1,000 cubic feet shall not exceed: For an illuminating supply, first period of 10 years, $1 50; second 10 years, $1.25; third 10 years and thereafter, $1. For cooking, heating and power use, first 10 years, $1; second 10 years, 90 cents; third 10 years, and thereafter, 75 cents. The city is also authorized to purchase the plant, for operation on public account, at the end of each period of 10 years, provided notice of such intention is given to the Company at least 12 months before the condemnation proceedings are instituted. The selling price is to be adjusted by means of arbitration. Our correspondent closes with the rather cynical remark, "It is not a certainty that the works will ever be operated on public account, simply through the possibility that the works will never be built."

THE annual meeting of the Wilmington (N. C.) Gas Light Company was held on April 26th, Colonel J. W. Atkinson acting as Chairman, the Secretary's duties being performed by Captain Henry Savage. The annual report of the Treasurer (Mr. R. J. Jones) was read and discussed. Its figures proved that the Company had enjoyed a prosperous year. The report of the auditing committee was read and accepted, after which the following Directors were elected: E. S. Martin, G. W. Kidder, George R. French, J. F. Devine. E. P. Bailey, G. H. Smith and B. Solomon. On the adjournment of the shareholders' meeting the Directors perfected the following executive organization: President, E. S. Martin; Secretary and Treasurer, R. J. Jones; Superintendent, J. W. Reilly.

THE plant of the Medina (N. Y.) Gas and Electric Light Company will be offered for sale by the receiver on the 28th inst.

THE Boston (Mass.) *Herald*, of April 28th, says that the Board of Gas and Electric Light Commissioners has issued an order permitting the Dedham and Hyde Park Gas and Electric Light Company to issue $60,000 first mortgage bonds at 5 per cent., to run 20 years, $12,000 being to cancel indebtedness, and $48,000 for enlargements. The Commission for the first time uses its power to limit dividends for the purpose of securing a reduction of capital. The Company voted to reduce its stock, from 2,000 shares, par value $50, to 1,600 shares, by exchanging shares for notes. This would not of course in any way decrease its indebtedness, and so the Commission, by its order, provides that it shall not declare any dividends above 3 per cent., until a sufficient number of stock certificates have been cancelled to carry into effect the vote to reduce the stock, or until otherwise ordered by the Board.

AT the annual meeting of the Elgin (Ills.) American Gas Company the following Directors were chosen: Thomas Leaming, L. A. Riley, E. H. McCullough, Geo. G. Ramsdell and M. W. Stroud.

THE Philadelphia *Ledger*, of last Tuesday, had this mention of the annual meeting of the United Gas Improvement Company: "The annual meeting of the stockholders of the United Gas Improvement Company was held at noon, yesterday, at the offices of the Company in the Drexel Building. Representatives of the press were excluded, none but holders of shares being admitted. The chief matter of interest to be acted upon by the meeting was the proposed increase of the capital stock, from $11,500,000 to $15,000,000, which was voted with practical unanimity. President Dolan read the annual report, which set out in minute detail the operations of the Company during 1897, and in particular recounted the history of the lease of the city gas works. The profits for the year were stated at $1,424,289.68, a gain of $142,141.58 over the previous year. The net gain from the sales of gas was $310,665.97. The report stated that it would require two years to put the gas works of Philadelphia in the best condition for profitable working. The financing of the Equitable Illuminating Company, which was reorganized to operate the Philadelphia gas works, was said to have formed an important part of the President's report. The new Company issued bonds to the amount of $7,500,000, and stock to the amount of $6,250,000, of which $3,125,000 is preferred, and draws interest for the first year at 4 per cent., and thereafter at 6 per cent., and $3,125,000 of common stock. The reports were approved, and the retiring Board of Directors was re-elected, as follows: Messrs. Thos. Dolan, George Philler, P. A. B. Widener, William L. Elkins, William W. Gibbs, Clement A. Griscom and Samuel T. Bodine; President, Thomas Dolan. The Board of Directors met later in the day and decided to offer the increased capital stock to holders of record, on the 20th day of May, pro rata, at par, payable in instalments, as follows: 25 per cent., July 15, 1898; 25 per cent., October 15, 1898; 25 per cent., January 15, 1899; 25 per cent., April 15, 1899."

AT the annual meeting of the Philadelphia (natural gas) Company, held the 2d inst., the annual report for the year ended March 31st, had much of interest. It showed net earnings of $491,422.21. The surplus for the year to profit and loss, was $416,422.31. The earnings from gas sales amounted to $1,410,838.67; from dividends on stock of the Allegheny Heating Company, and on stock of other companies, $66,285; from oil, $32,553.24, a total of $1,509,676.91. The operating expenses were returned at $746,762.83, the largest item being $217,819.78, for new gas wells. Out of the earnings $163,626.33 were paid for leases, etc. During the year 11,719,657,000 cubic feet of gas were sold, 60 wells were drilled, 48 miles of pipe were laid, and 16 miles reclaimed, making the total length of lines operated equal 925 miles. Of the wells drilled, 44 produced gas, 3 oil, and 13 nothing. Three wells were purchased; the producing wells number 319. A gasholder equal to retaining 5,000,000 cubic feet is to be erected in Allegheny. The Company's annual rentals amount to $44,614.91, and its royalties on wells to $41,808.83.

DURING the past year the gain in output by the Chuctanunda Gas Light Company, of Amsterdam, N. Y., amounted to 20 per cent., the comparison of course being made on the sendout of the previous twelvemonth. This shows that the public has some faith in the thought that a reduction in selling rates does mean something—the Amsterdam gas men made quite a concession in the rates some months ago.

THE village of Canisteo, N. Y., is to be lighted with gas, which supply is to be obtained from the gas plant at Hornellsville.

THE rate for natural gas at Richmond, Ind., has been increased from 12½ to 15 cents per 1,000.

THE United Gas Improvement Company is building for the Washington (D. C.) Gas Light Company a standard double superheater Lowe water gas apparatus up to a daily capacity of about 4,000,000 cubic

feet. The installation covers the generating machinery, scrubbers, condensers, iron floor, engines, blowers, etc. As was previously reported in the JOURNAL, the Washington Company is also to add a holder, rated to contain 1,000,000 cubic feet, to its storage plant.

ANOTHER contract, awarded to the United Gas Improvement Company, is that made with the City of Flint Gas Light Company, of Flint, Mich. Under the agreement a standard double superheater Lowe water gas apparatus, of a capacity of 125,000 cubic feet per day, will be constructed.

MR. STEPHEN KEEFER, one of the promoters of the Hanover (Pa.) Gas Company, died at his home in Hanover on April 27th. Deceased, who was born in Baltimore, Md., in 1816, settled in Hanover in 1848, and subsequently became identified with almost every enterprise of moment in and about Hanover.

THE following sections are from the ordinance granting the Hackensack (N. J.) Gas and Electric Company the right to supply gas and electric currents in the outlying village of Ridgefield Park:

"Section 2. That * * * the said Hackensack Gas and Electric Company, its successors and assigns will furnish gas to the inhabitants of said village, under such reasonable regulations as it may deem necessary to impose, at the following rates, to wit: $1.90 per 1,000 cubic feet, for monthly consumption up to 3,000 cubic feet; $1.80 per 1,000 cubic feet, for monthly consumption from 3,000 cubic feet to 6,000 cubic feet; $1.70 per 1,000 cubic feet for monthly consumption of 6,000 cubic feet or more. And that at the expiration of 5 years from the date when the said Company shall commence the supply of gas under this franchise, it will furnish gas to the inhabitants of said village at the following rates, to wit: $1 70 per 1,000 cubic feet for monthly consumption up to 1,000 cubic feet; $1.50 per 1,000 cubic feet for monthly consumption of 1,000 cubic feet or more. The said rates being net prices to consumers paying or satisfying their bills on or before the 15th day of each month in which they are rendered, and the quantity of consumption to determine such prices is to be based upon the reading of each individual meter.

"Sec. 3. And also in consideration of the grant of the aforesaid rights and privileges, the said Hackensack Gas and Electric Company, its successors and assigns, will furnish and supply commercial electric lighting in the stores, dwellings and other buildings within the limits of said village at the prices and terms now prevailing in the village of Hackensack.

"Sec. 4. And as a further consideration the said Company binds itself, its successors and assigns, at any and all times, to give to the residents of the village of Ridgefield Park the same and equal benefits of any reduction in prices made to the residents of any section served by it.

"Sec. 5. That as a further consideration or condition, not less than 3 miles of mains for supplying gas as aforesaid, shall be laid and completed within 6 months from the date of this ordinance, and at least 3 miles additional shall be laid and completed within one year from the date thereof.

"Sec. 6. That at any time hereafter that the Trustees of said village may desire to light the streets and public places in the said village by gas, the said Company, its successors and assigns, will furnish and set all necessary posts, lamps and appliances for such lighting, upon a two-year contract, at the rate of $17 per lamp per year, provided 75 or more lamps are required; and provided further that the furnishing or placing of any such lamps at points or places to which the mains of the Company may not at such time extend shall be at the option of said Company.

"Sec. 7. That such Company shall make all necessary connections, with its mains for its consumers; provide and lay, without charge, service pipes from its mains for a distance not exceding 50 feet from the curb line, charging for any excess over said distance at the actual cost of the same to the said Company; provide and set all necessary meters without charge to consumers; and during one year from the date when such supply of gas shall be commenced shall furnish, free of cost, one 2-burner gas cooking stove to each consumer desiring the use of same. The ordinance took effect April 18th.

THE Philadelphia *Record* says: "Plans and specifications for the large office building to be erected for the United Gas Improvement Company, on the site of the First Baptist Church, at the northwest corner of Broad and Arch streets, are understood to be rapidly nearing completion. The structure will be 12 stories high. The lower floor will be used as the business office, and the upper ones will be occupied as the general offices of the Company. It will have a frontage of 113 feet on Broad street, by about 80 feet on Arch street. The two lower stories will be of granite; above that the structure will be of brick, relieved by terra cotta. The cornice will be approximately 170 feet above the curb. There will be about 150 rooms, arranged in suites for the convenience of the business. There will be three elevators. The building will be lighted solely by gas, applied in the most approved fashion. The elevators will be run by power supplied by large gas engines located in the basement. The entrance to the first floor will be on Broad street, in the center of the building's length; the entrance to the elevators will be on Arch street. It is proposed to make the interior handsome, but plain. The building will have windows on all sides."

THE Peoples Gas Light and Coke Company, of Chicago, has had great success this season in putting gas ranges in service, several thousand having been placed since March 1st. The ranges are sold at cost price, and payment for them is taken in sums of from 50 cents to $1.25 per month.

THE project for the establishment of a gas works to operate in Cinnaminson and Riverton, Burlington county, N. J., has been revived. The name of the proposed corporation is the Cinnaminson Gas Company.

MR. H. B. ADAM, Secretary of the Gas Light Company of Augusta, Ga., recently issued the following card respecting the change in selling rates by the Company, which change was briefly noted some time ago in the JOURNAL: "All consumers of gas will please take notice that our reduced charges on all gas consumed for month of April will take effect on bills presented May 1st. Your bills will be made out at $2 per 1,000 cubic feet, and a discount of 50 cents per 1,000 cubic feet will be allowed on all bills paid on presentation or at our office by the 10th day of each month, making the net amount $1.50 per 1,000 cubic feet. If our collectors are obliged to call upon you after that time our price will be $2.50 per 1,000 cubic feet in all cases. We give you timely notice, so you may avail yourselves of the discount."

MR. CHARLES W. FIELD, on behalf of the Clyde (N. Y.) Gas and Electric Company has applied to the Village Trustees for the same franchises and privileges that had been enjoyed by the Clyde Electric Company and the Clyde Gas Light Company prior to the consolidation of the named concerns.

THE Cincinnati Gas Light and Coke Company is extending its mains to the district of Norwood.

THE street lighting of Bridgeport, Conn., has been greatly improved this year, the authorities having evidently made up their minds that efficient street illumination is a good advertisement for a wideawake place. Not the least important part played in the betterment is the Welsbach street lighting installation, which, if memory serves us right, is eventually to comprise at least 200 lamps.

"W. J. M." is informed that the Secretary of the Jenkintown and Cheltenham (Pa.) Gas Company is Mr. Frederick H. Shelton.

The Audibility of Thunder.

While lightning may be seen and its illumination of clouds and mist may be recognized when it is even 200 miles distant, thunder is rarely audible more than 10 miles. The thunder from very distant storms, therefore, seldom reaches the ear, says *Industries and Iron*. The reason of the great uncertainty in the audibility of thunder is not difficult to understand. It depends not merely on the initial intensity of the crash, but quite as much on the surroundings of the observer, even as in the quiet country one will observe feeble sounds that escape the ear in a noisy city. Perhaps the most curious and important condition of audibility is that the thunder wave of sound shall not be refracted or reflected by the layers of warm and cold air between the observer and the lightning or by the layers of wind, swift above and slow below, so as to entirely pass over or around the observer.

Sound, in its wavelike progress obliquely through layers of air of different densities, is subject to refraction, and this refraction may occur at any time and place. Thus, observers at the topmast of a ship frequently hear fog whistles that are inaudible at sea level; those on hilltops hear thunder that cannot be heard in the valley; those in front of an obstacle hear sounds inaudible to those behind it. The rolling of thunder, like that of a distant cannonade, may be largely due to special reflections and refractions of sound. Again, the greater velocity of the air at considerable altitude above the ground distorts the sound wave and shortens the limit of audibility to the leeward, while increasing it to windward.

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TEXAS GAS AND ELECTRIC LIGHT ASSOCIATION.

MONDAY, MAY 9, 1898.

The Market for Gas Securities.

Reference to the heading will show that our quotations are now furnished by Messrs. Frederic B. Cochran & Co., Nos. 20 and 22 Broad street, New York. The firm comprises Frederic B. Cochran, George W. Close and George D. Stevens. Quotations for gas shares, especially on city account, show marked gains, the net advance in Consolidated having been 10¾ points for the week in the bid price. The opening to day (Friday) was made in it at 184¾ to 185. All other city shares made marked gains. Of course, the international situation at its present stage is responsible for the return of confidence. Brooklyn Union is up to 116¼; Consolidated, of Baltimore, is strong, at 61¼ to 61½. In fact, as said before, everything is on the high side, with a strong probability that prices will go very much beyond present quotations, and that without delay.

Gas Stocks.

Quotations by Frederic B. Cochran & Co., Brokers and Dealers in Gas Stocks.

20 AND 22 BROAD STREET, NEW YORK CITY.

MAY 9.

☞ All communications will receive particular attention

☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$36,230,000	100	184¾	185
Central	500,000	50	..	..
" Scrip	220,000	..	100	.
Cental Union, Bonds, 5's	3,000,000	1,000	99½	100
Equitable	4,000,000	100	206	215
Bonds, 6's	1,000,000	1,000	105	..
" 1st Con. 5's	2,300,000	1,000	114	.
Metropolitan Bonds	658,000	..	108	112
Mutual	,500,000	100	200	800
" Bonds	1,500,000	1,000	100	102
Municipal Bonds	750,000	.	..	.
New Amsterdam Gas Co.	13,000,000	100	27½	29
Preferred	10,000,000	100	62	63
Bonds, 5's	11,000,000	1,000	94½	96
Northern	150,000	50	..	..
" Bonds	150,000	1,000	..	
Northern Union, Bonds, 5's	1,250,000	1,000	94½	95½
New York and East River	5,000,000	100	81	83
Preferred	2,000,000	100	112	115
Bonds 1st 5's	3,500,000	1,000	108	111
" 1st Con. 5's	1,500,000	..	104	106
Richmond Co., S. I.	348,650	50	70	..
" Bonds	100,000	1,000	..	..
Standard	5,000,000	100	127	135
Preferred	5,000,000	100	142	149
Bonds, 1st Mortgage, 5's	1,500,000	1,000	114	115
Yonkers	299,650	50	130	..
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	116¼	118
" " Bonds (5's)	15 000,000	1,000	111	112
Bay State	50,000,000	50	3⅝	3¾
" Income Bonds	2,000,000	1,000	..	75
Boston United Gas Co.—				
1s Series S. F. Trust	7,000,000	1,000	89	90
2d " " "	3,000,000	1,000	..	70
Buffalo City Gas Co.	7,000,000	100	26	28
" " Bonds, 5's	7,000,000	1,000	90	92
Central, San Francisco	2,000,000	..	95	..
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	104¼
Columbus	1,069,000	.	89	91
1st Mortgage	1,085,000	..	101	103½
Consumers, Jersey City	2,000,000	100	75	80
" Bonds	600,000	1,000	102½	105
Cincinnati G. & C. Co.	8,500,000	100	195	196
Consumers, Toronto	1,600,000	50	184½	187
Capital, Sacramento	500,000	50	..	85
Bonds (6's)	150,000	1,000	..	.
Consolidated, Baltimore	11,000,000	100	61⅜	61¼
Mortgage, 6's	3,600,000	..	107	107½
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490,000	..	..	..
Consolidated G. & E. Co.'s, Little Falls, N.Y.	90,000	100	..	100
Bonds	75,000	..	..	100
Detroit	4,000,000		48	51
" Con. Bonds	4,312,000	..	..	95
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Fort Wayne	2,000,000	..	78	81
" Bonds	2,000,000	..	89	91
Hartford	750,000	25	..	145
Indianapolis	2,000,000	..	115	125
" Bonds, 6's	2 650,000	..	106	107
Jersey City	750,000	20	180	..
Lafayette Gas Co., Ind.	1,000,000	100	78	83
Bonds	1,000,000	1,000	90	91
Louisville	2,370,000	50	..	..
Laclede, St. Louis	7,500,000	100	46	46¾
Preferred	2,500,000	100	85	87½
Bonds	9,084,400	1,000	100	101
Montreal, Canada	2,000,000	100	200	.
Newark, N. J., Gas Co.	1,000,000	..	200	220
Bonds, 6's	4,000,000	..	128	130x
New Haven	1,000,000	25	252	..
Oakland, Cal.	2,000,000	..	53½	54
" Bonds	750,000	..	..	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	94	94¼
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,00	1,000	..	108
2d "	2,500,000	1,000	104	105
Peoples, Jersey City	500,000	50	..	175
Rochester Gas & Elec. Co.	2,150,000	50	..	..
Preferred	2,150,000	50	88	..
Consolidated 5's	2,000,000	..	87½	90
San Francisco, Cal.	10.000,000	100	94	94¼
St. Paul Gas Light Co.	1,500,000	100	49	51
1st Mortgage 6's	650,000	..	84	87
Extension, 6's	600,000	..	..	..
General Mortgage, 5's	2,400,000	.	88	90
Syracuse, N. Y.	2,500,000	25	17	19
Bonds	1,000 000		94	97
Washington, D. C	2,000,000	20	220	
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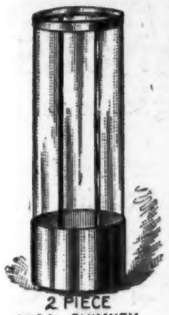

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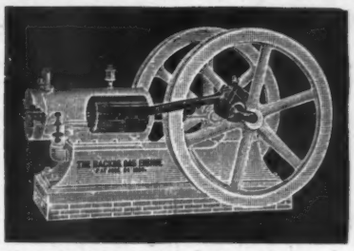

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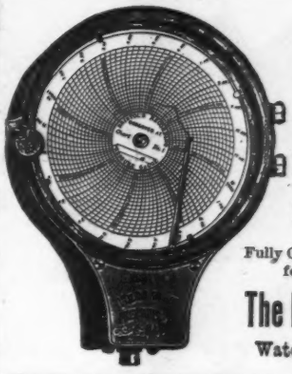

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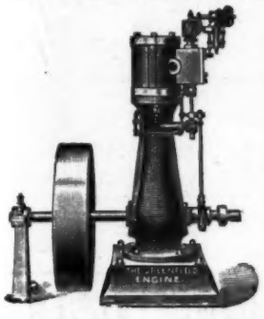

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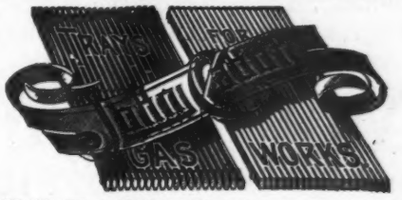

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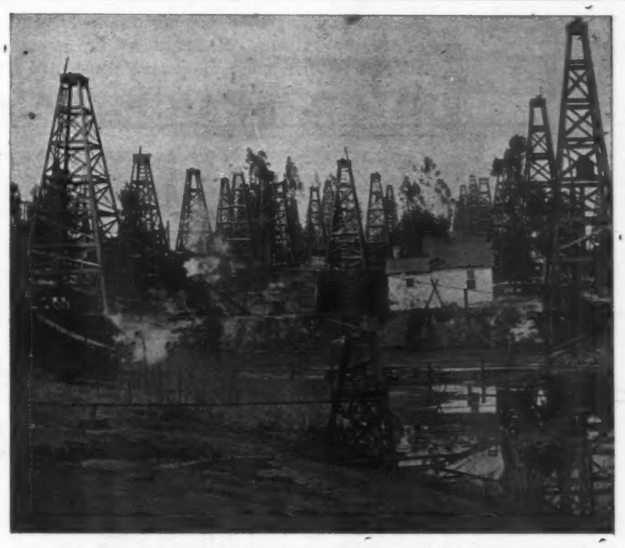

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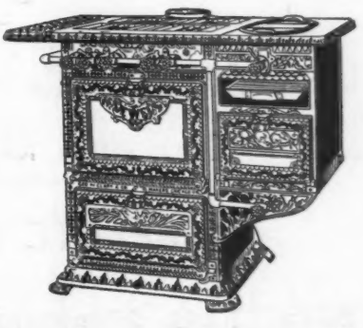

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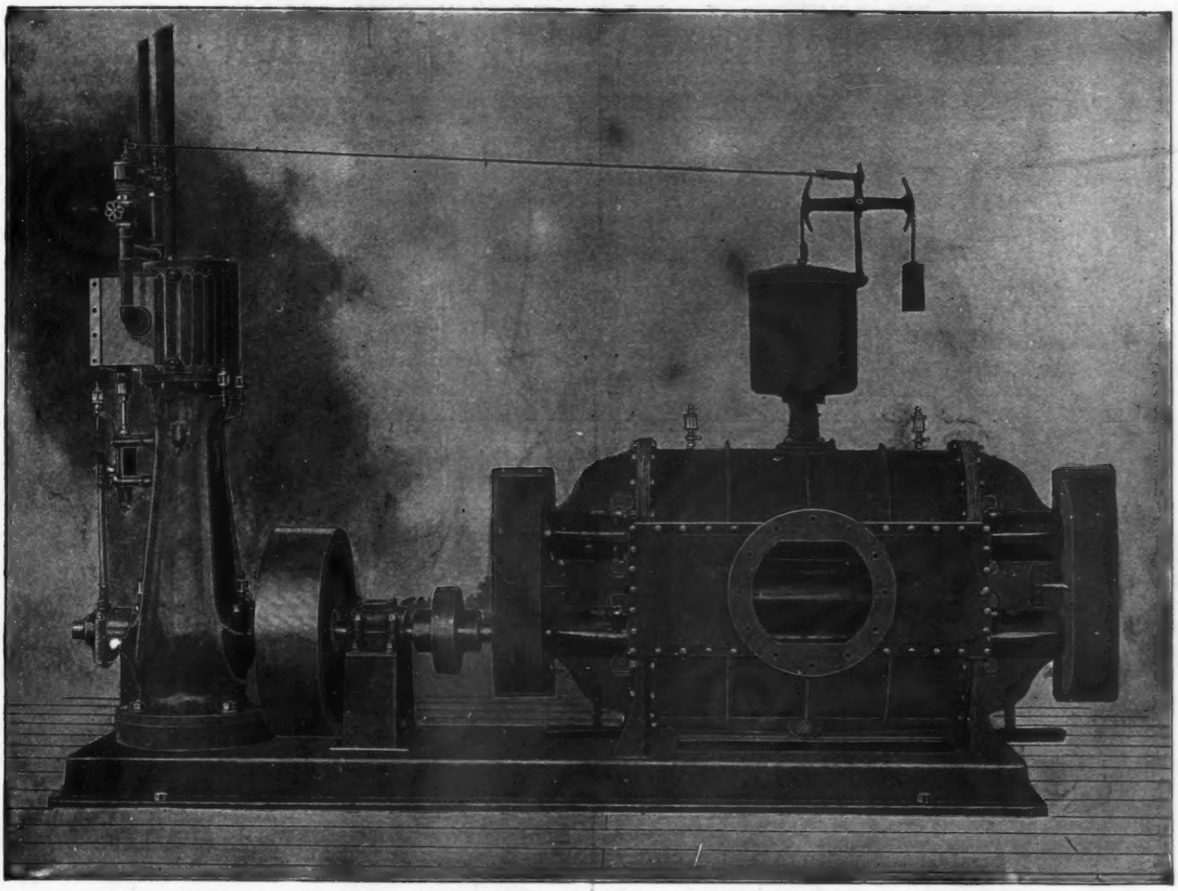

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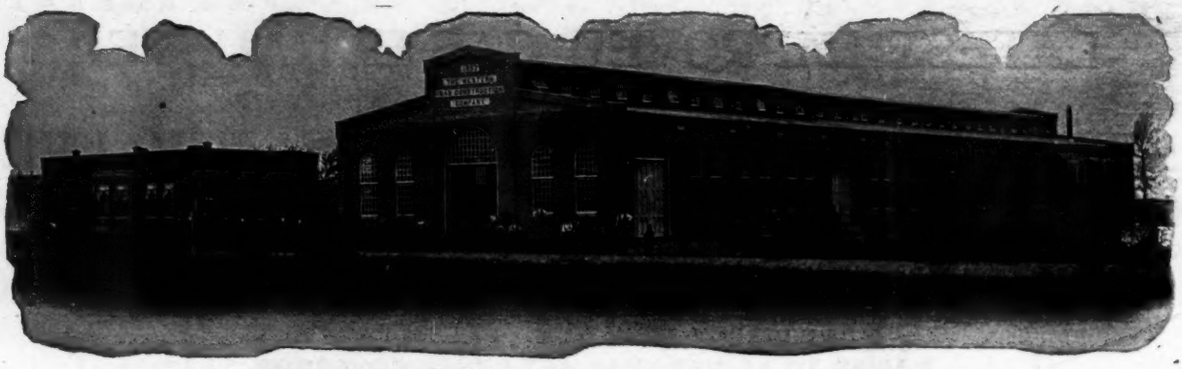

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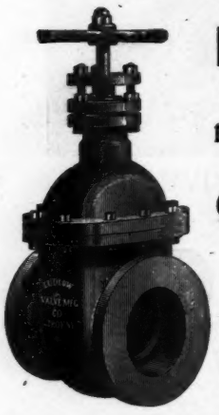

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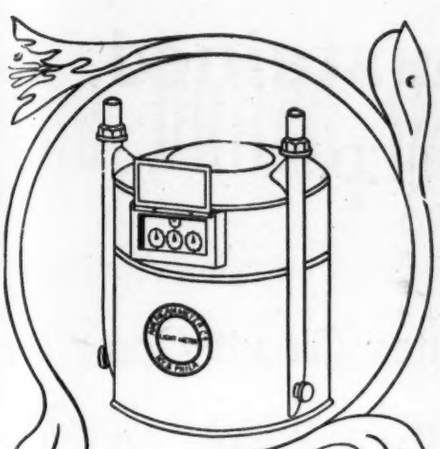
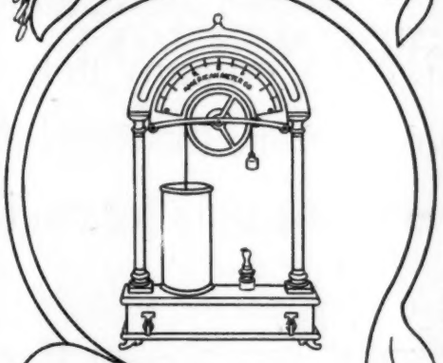
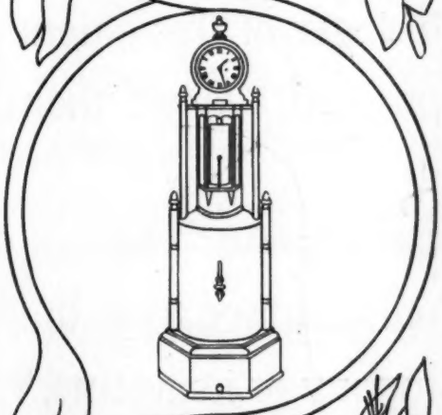
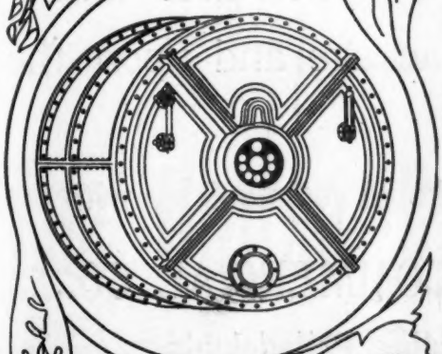








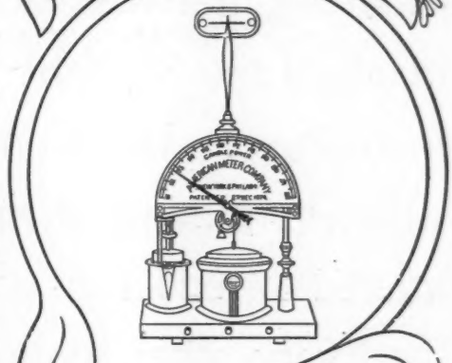
PUBLIC LIGHTING TABLE.

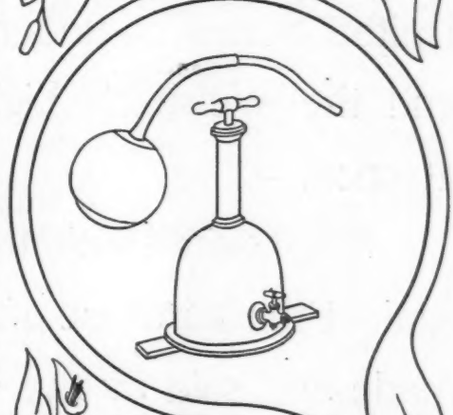
MAY, 1898.

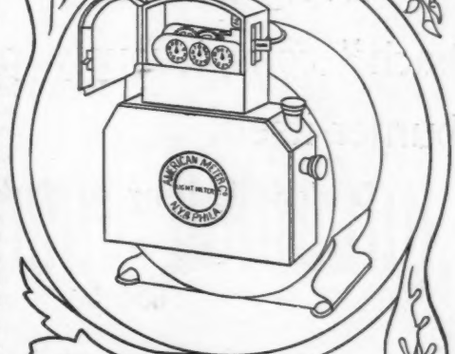
Day of Week.	Date.	Table No. 1. Following the Moon. Light.	Table No. 1. Following the Moon. Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Table No. 2. New York City. All Night Lighting. Extinguish.
				P.M.	A.M.
Sun.	1	1.30 AM	4.00 AM	6.45	4.00
Mon.	2	2.00	4.00	6.45	4.00
Tue.	3	2.30	4.00	6.45	4.00
Wed.	4	No L.	No L.	6.45	4.00
Thu.	5	No L. FM	No L.	6.45	4.00
Fri.	6	No L.	No L.	6.45	4.00
Sat.	7	7.30 PM	10.10 PM	6.55	3.40
Sun.	8	7.30	11.20	6.55	3.40
Mon.	9	7.30	12.10 AM	6.55	3.40
Tue.	10	7.30	12.50	6.55	3.40
Wed.	11	7.30	1.30	6.55	3.40
Thu.	12	7.30 LQ	2.00	6.55	3.40
Fri.	13	7.30	2.30	6.55	3.40
Sat.	14	7.30	2.50	7.00	3.30
Sun.	15	7.40	3.10	7.00	3.30
Mon.	16	7.40	3.40	7.00	3.30
Tue.	17	7.40	3.40	7.00	3.30
Wed.	18	7.40	3.40	7.00	3.30
Thu.	19	7.40	3.40	7.00	3.30
Fri.	20	7.40 NM	3.40	7.00	3.30
Sat.	21	7.40	3.40	7.10	3.15
Sun.	22	7.50	3.40	7.10	3.15
Mon.	23	7.50	3.40	7.10	3.15
Tue.	24	7.50	3.40	7.10	3.15
Wed.	25	10.20	3.40	7.10	3.15
Thu.	26	10.40	3.40	7.10	3.15
Fri.	27	11.10	3.40	7.10	3.15
Sat.	28	11.30 FQ	3.40	7.15	3.15
Sun.	29	12.00	3.30	7.15	3.15
Mon.	30	12.20 AM	3.30	7.15	3.15
Tue.	31	12.50	3.30	7 15	3 15

TOTAL HOURS LIGHTING DURING 1898.

By Table No. 1.	Hrs. Min.	By Table No. 2.	Hrs. Min.
January	210.40	January	423.20
February	186.40	February	355.25
March	181.20	March	355.35
April	166.10	April	298.50
May	156.40	May	264.50
June	144.30	June	234.25
July	147.30	July	243.45
August	157.10	August	280.25
September	169.50	September	321.15
October	186.00	October	374.30
November	204.30	November	401.40
December	218.30	December	433.45
Total, yr.	2129.30	Total, yr.	3987.45







Welsbach Patent Sustained.

INJUNCTION GRANTED.

JUDGE TOWNSEND, in the United States Circuit Court for the Southern District of New York, has handed down a decision sustaining the Welsbach Light Company's Rawson Patent, and adjudged the Sunlight Incandescent Gas Lamp Company to be an infringer. This Company has been enjoined from the further use of its method of manufacture of incandescent mantles, and ordered to render an accounting.

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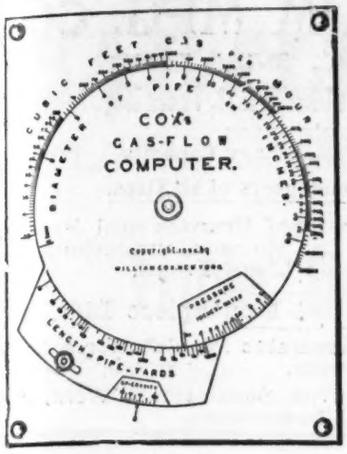

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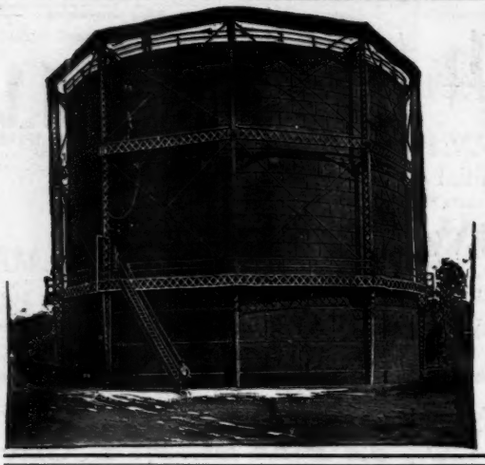

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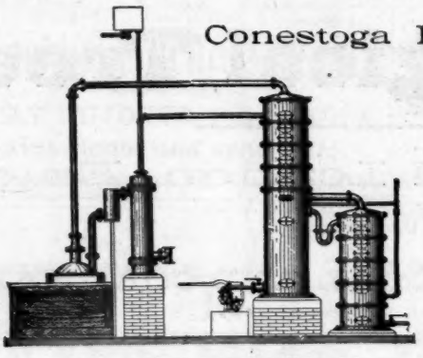

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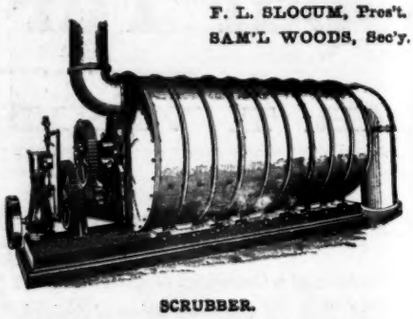

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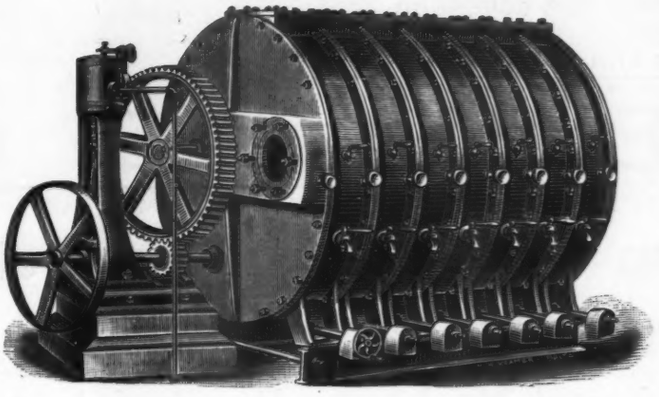

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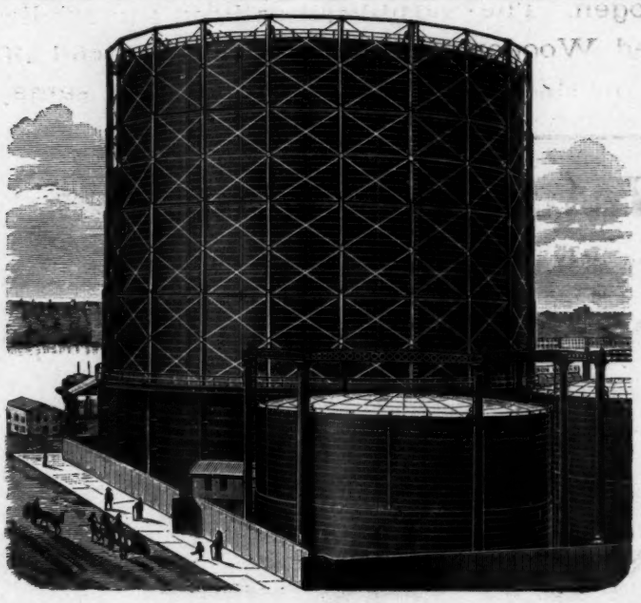

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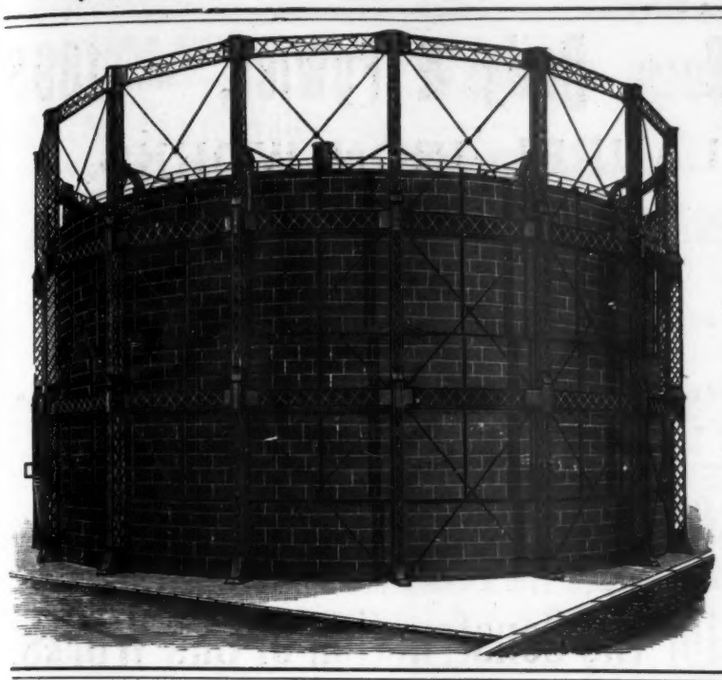

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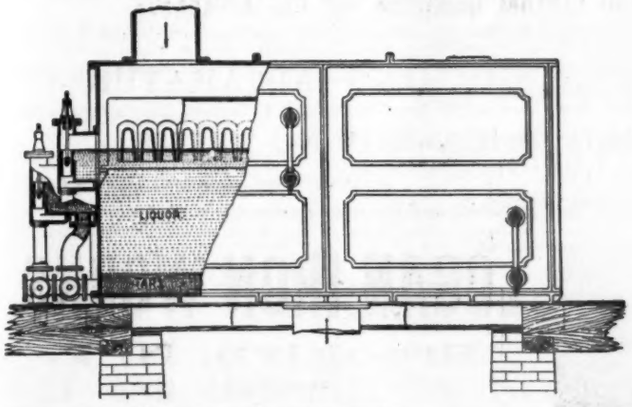

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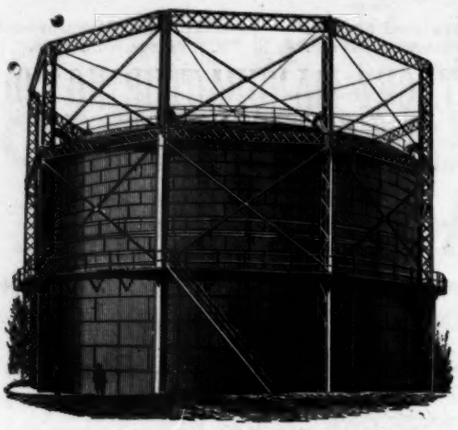

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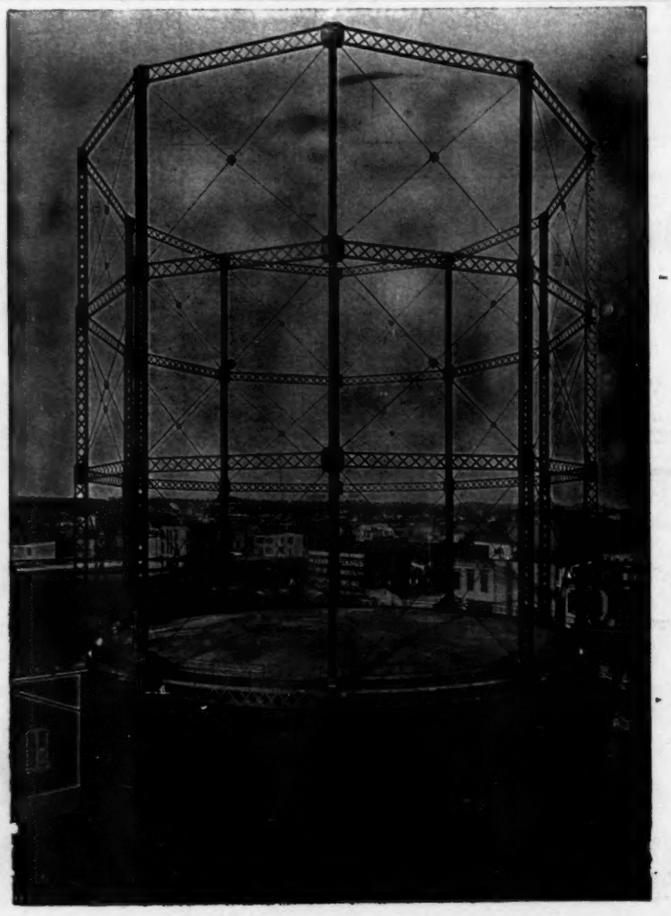

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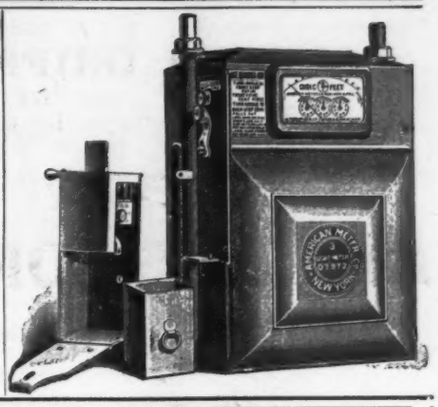

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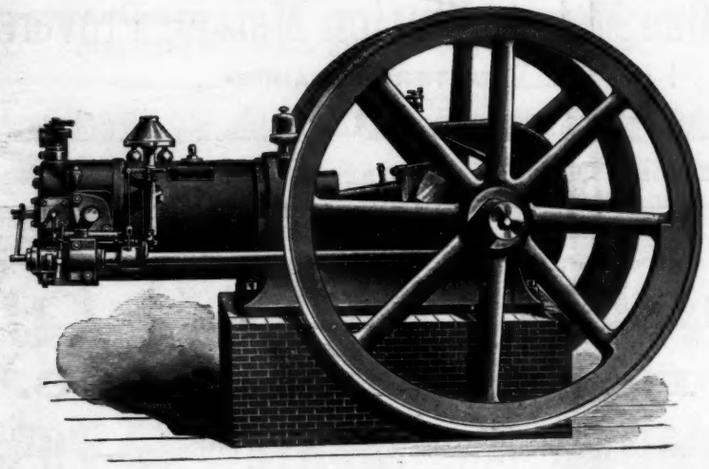

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